March 1971
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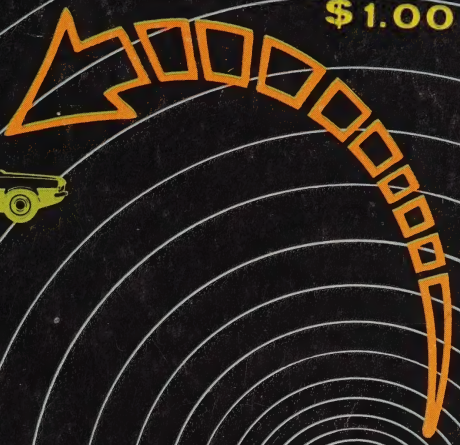
CQ



SPECIAL PART 2

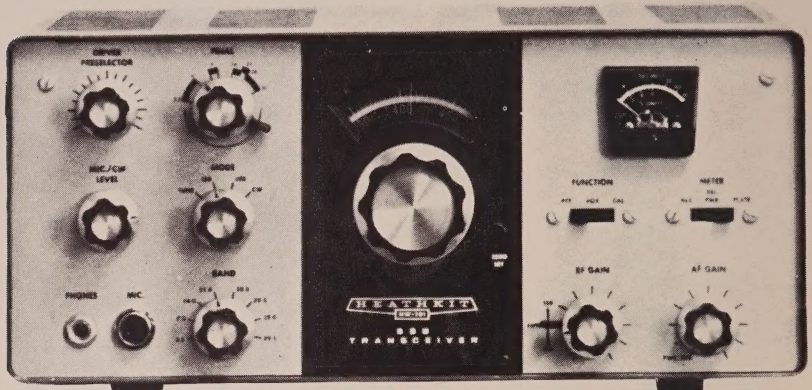
FM REPEATER CONTROL

9 APR 1971

The Radio Amateur's Journal

08240

better than the "Hot-Water 100" ...and a nickel cheaper



NEW Heathkit® HW-101... $249.95*

World's best low cost rig is now even better. The Hams at Heath have done it again... by adding important new performance features to the famous HW-100... without adding to the price. That's Heathkit value... and this is the rig...

Improved receiver circuitry now delivers 0.35 uV sensitivity for 10 dB S+N/N.

Improved dial drive mechanism. New ball-bearing drive assembly provides a 36 to 1 knob to dial turning ratio... delivers 34 velvet-smooth knob revolutions per 500 kHz band segment.

Front panel switch selection of SSB or CW filters. Now choose the built-in 2.1 kHz or optional 400 Hz filter with just a flip of a switch.

Plus all the features that made the "100" the world's most popular transceiver. Add it all up and you've got the new HW-101... a lot more rig for a little less money. From the Hams at Heath, of course.

Kit HW-101, 23 lbs. **$249.95***

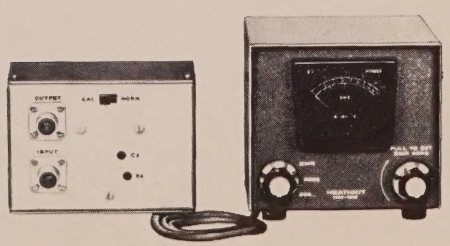
Kit HP-23A, AC supply, 19 lbs. **$51.95***

Kit HP-13A, DC supply, 7 lbs. **$69.95***

SBA-301-2, 400 Hz CW filter, 1 lb. **$21.95***

SBA-100-1, mobile mount, 6 lbs. **$14.95***

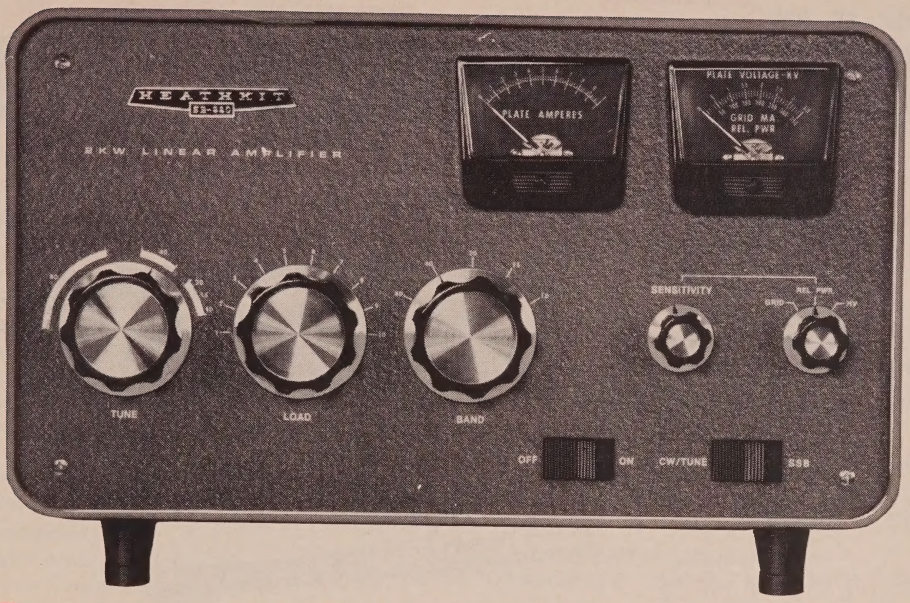
HW-101 SPECIFICATIONS — RECEIVER: Sensitivity: Less than 0.35 microvolt for 10 dB signal-plus-noise to noise ratio for SSB operation. **SSB selectivity:** 2.1 kHz minimum at 6 dB down; 7 kHz maximum at 60 dB down (3.395 MHz filter). **CW selectivity:** (with optional SBA-301-2 CW crystal filter installed); 400 Hz min. @ 6 dB down; 2.0 kHz max. @ 60 dB down. **Input:** Low impedance for unbalanced coaxial input. **Output impedance:** 8 ohm speaker, and high impedance headphone. **Power output:** 2 watts with less than 10% distortion. **Spurious response:** Image and IF rejection better than 50 dB. **TRANSMITTER: DC power input:** SSB, (A3J emission) 180 watt PEP (normal voice, continuous duty cycle). CW, (A1 emission) 170 watts (50% duty cycle). **RF power output:** 100 watts on 80 through 15 meters; 80 watts on 10 meters (50 ohm nonreactive load). **Output impedance:** 50 ohm to 75 ohm with less than 2:1 SWR. **Oscillator feed-through or mixer products:** 55 dB below rated output. **Harmonic radiation:** 45 dB below rated output. **Transmit-receive operation:** SSB: PTT or VOX. CW: Provided by operating VOX from a keyed tone, using grid-block keying. **CW side-tone:** Internally switched to speaker or headphone in CW mode. Approximately 1000 Hz tone. **Microphone input:** High impedance with a rating of –45 to –55 dB. **Carrier suppression:** 45 dB down from single-tone output. **Unwanted sideband suppression:** 45 dB down from single-tone output at 1000 Hz reference. **Third order distortion:** 30 dB down from two-tone output. **RF compression (TALC*):** 10 dB or greater at .1 mA final grid current. **GENERAL: Frequency coverage:** 3.5 to 4.0; 7.0 to 7.3; 14.0 to 14.5; 21.0 to 21.5; 28.0 to 28.5; 28.5 to 29.0; 29.0 to 29.5; 29.5 to 30.0 (megahertz). **Frequency stability:** Less than 100 hertz per hour after 30 minutes warmup from normal ambient conditions. Less than 100 Hz for ±10% line voltage variations. **Modes of operation:** Selectable upper or lower sideband (suppressed carrier) and CW. **Dial calibration:** 5 kHz. Calibration: 100 kHz crystal. **Audio frequency response:** 350 to 2450 Hz. **Transistors:** MPF105 FET–VFO; 2N3393–Voltage regulator. **Rear apron connections:** CW Key jack; 8 ohm output; ALC input; Power and accessory plug; RF output; Spare. **Power requirements:** 700 to 850 volts at 250 mA with 1% maximum ripple; 300 volts at 150 mA with .05% maximum ripple; –115 volts at 10 mA with .5% maximum ripple; 12 volts AC/DC at 4.76 amps. **Cabinet dimensions:** 14 13/16" W x 6 5/16" H x 13 3/8" D.
*Triple Action Level Control™



New Heathkit® Wattmeter... $29.95*

You asked for it ... a low cost high quality Heathkit wattmeter. New HM-102 measures RF power output from 10-200 W and 100-2000 W in two switch-selected ranges. Built-in calibrator permits 10% accuracy throughout the 80-10 M bands. Built-in SWR capability. Negligible loss permits permanent insertion in any 50 ohm line. Exclusive remote detector allows placement of meter in any location. Put the new HM-102 in your shack now... it's another powerful value from the Hams at Heath.

Kit HM-102, 3 lbs. **$29.95***



Turn on your Benton Harbor maxi-rig!

The New Heathkit® SB-220

Business end of the Maxi-Rig! Gives your signal the authority it takes to punch through those pile-ups (or start one yourself). And keeps you operating under conditions that drive the other guys QRT.

A pair of conservatively rated Eimac 3-500Z's provide up to 2000 watts PEP SSB input . . . 1000 watts on CW *and* RTTY. Requires only 100 watts PEP drive. Pretuned broad band pi-input coils deliver maximum efficiency and low distortion on the 80-10 meter bands.

The built-in solid-state power supply can be wired for either 120 or 240 VAC and switched back again in minutes if your power requirements change. Circuit breakers provide added protection and eliminate costly fuse changing. And for cooler operation and extended tube life, idling plate current is reduced by Zener diode regulated bias.

The layout of the new "220" is designed for fast, high volume air flow with a husky, quiet fan in the PA compartment doing the job. Result: the "220" actually runs cooler than most exciters.

Other features include two front panel meters for continuous monitoring of Ip plus switch-selected monitoring of Rel. Pwr., Ep & Ig . . . ALC output to reduce overdriving and distortion . . . safety interlocked cover . . . easy 15-hour assembly and handsome Heathkit SB-Series styling.

Tired of stumbling barefoot through the QRM? Order the shoes for your Maxi-Rig now . . . the new "220" . . . another hot one from the Hams at Heath.

• Full 2 kW PEP input on SSB . . . 1 kW on CW and RTTY • Boardband pi-input on 80 through 10 meters • Two Eimac 3-500Z tubes • 120 or 240 VAC wiring options • Zener diode regulated operating bias for reduced idling plate current, longer tube life, cooler operation • Double shielded to reduce stray radiation • Solid-state power supply • Two front panel meters for continuous monitoring of plate current, plus switch selected monitoring of Rel. Pwr., plate high voltage and grid current • Quiet, high volume fan for cool running • ALC output • Easy 15 hour assembly.

Kit SB-220, 55 lbs.....**$349.95***

SB-220 SPECIFICATIONS — **Band coverage:** 80, 40, 20, 15 and 10 meter amateur bands. **Driving power required:** 100 watts. **Maximum power input:** SSB: 2000 watts P.E.P. CW: 1000 watts. RTTY: 1000 watts. **Duty cycle:** SSB: Continuous voice modulation. CW: Continuous (maximum key-down 10 minutes). RTTY: 50% (maximum transmit time 10 minutes). **Third order distortion:** —30 dB or better. **Input impedance:** 52 ohm unbalanced. **Output impedance:** 50 ohm to 75 ohm unbalanced; SWR 2:1 or less. **Front panel controls:** Tune, Load, Band, Sensitivity, Meter switch, Power CW/Tune — SSB, Plate meter, Multi-meter (Grid mA, Relative Power, and High Voltage). **Rear Panel:** Line cord, Circuit breakers (two 10 A). Antenna Relay (phono), ALC (phono), RF Input (SO-239). Ground post. RF output (SO-239). **Tubes:** Two Eimac 3-500Z. **Power required:** 120 VAC, 50/60 cycles, at 20 amperes maximum. 240 VAC, 50/60 cycles at 10 amperes. **Cabinet size:** 14⅞" W x 8¼" H x 14½" D. **Net weight:** 48 lbs.

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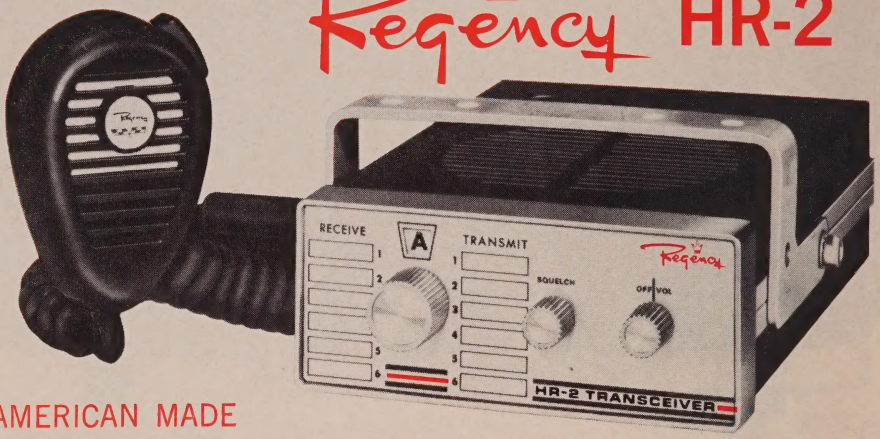
AM-238

Regency HR-2



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Mobile 2 Meter FM Transceiver

Here is what the 2 meter, FM Ham World has been asking for.

Specifications: 90 day warranty

RECEIVER

The HR-2 receiver is a double conversion, superhetrodyne with highly selective ceramic filter.

Frequency Range	144-148 MHz
Sensitivity	0.35 μv (nom.) 20DB Quieting
Selectivity	6DB Down ± 16KC 50DB Down ± 32KC
Audio Output (3-4 Ω Speaker)	3 Watts 10% Distortion 5 Watts Maximum
Channels	6 Crystal controlled with provision for adding an additional 6 channels
I.F. Frequencies	10.7 MHz & 455KHz

TRANSMITTER

The HR-2 transmitter uses phase modulation for the ultimate in carrier stability. Built in SWR load mismatch circuitry provides protection against open and shorted antenna conditions.

Frequency Range	144-148 MHz
Power Output	10 Watts (min.) @ 13.6 VDC
Modulation	Phase Modulation with automatic deviation limiting
Deviation	Automatic Limiting with internal adjustments from 0-15KC deviation
Microphone	Plug-in, hand held, high Z Ceramic supplied
Channels	6 Crystal controlled with individual trimmer capacitors for Frequency netting

GENERAL

Power Requirements	13.6 Volts (nominal)
Receive (Squelched)	180 MA.
Receive (Max. audio output)	800 MA.
Transmit	2.5 Amps (max.)

STANDARD EQUIPMENT

Built-in 4" Speaker
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SO-239 Antenna Connector Socket
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MARCH, 1971 VOL. 27, NO. 3

CQ The Radio Amateur's Journal

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Offices: 14 Vanderventer Avenue, Port Washington, L.I., N.Y. 11050. Telephone: 516-883-6200.

CQ (Title registered U.S. Post Office) is published monthly by Cowan Publishing Corp. Second Class postage paid at Port Washington and Miami, Florida. Subscription Prices: one year, $6.00; two years, $11.00; three years, $15.00. Entire contents copyrighted 1971 by Cowan Publishing Corp. CQ does not assume responsibility for unsolicited manuscripts. Allow six weeks for change of address. Printed in the United States of America.

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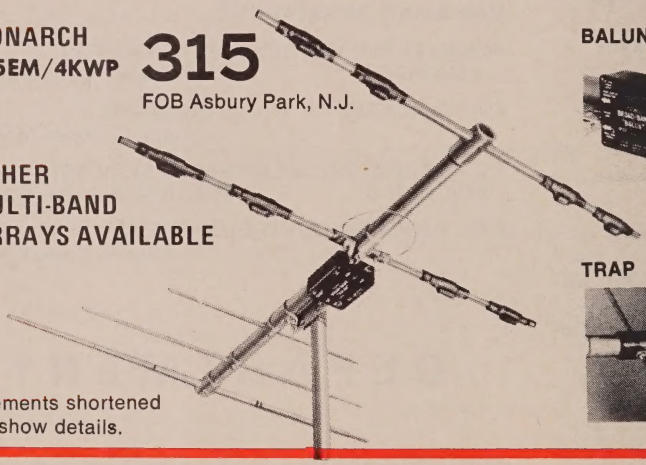
MONARCH TB5EM/4KWP **315**

FOB Asbury Park, N.J.

OTHER MULTI-BAND ARRAYS AVAILABLE



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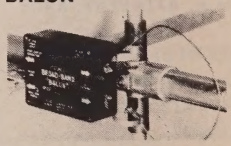

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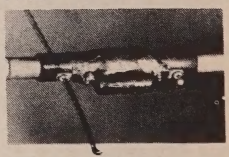

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Mod. 2M6C-	2 mtr. 6 el. array, 14 DB gain,300 W pow. rat., 1" x 9' boom	18.50
Mod. 2M814C-	2 mtr. 8 el. array, 16.5 DB gain,300 W pow. rat., 1.375"x14' boom	32.50
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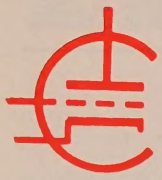


ZERO BIAS

It should be very obvious to *CQ* readers that some rather drastic changes have been taking place in the marketing of amateur radio equipment lately, and we feel that the time is right to examine and comment on these changes and the factors behind them. For many years the great bulk of ham equipment sales have been through electronic distributors with approximately half of these sales being made on a local basis and half achieved through the mail order route. Over the years, readers have become quite used to seeing ads by distributors featuring various brands of ham gear or catalogs of such equipment tailored for the ham customer. These distributors have become an integral part of the scheme of things within the industry.

But during recent years, the number of distributors stocking and selling ham equipment has dwindled from more than one hundred ten years ago to just a small handful today. Some of those distributors who remain in the marketplace have continued to sell only domestically-made gear, while others have expanded their operations to include privately labeled gear made in Japan, Hong Kong, England, etc. This trend has also become a part of the scheme of things, and we all accept it as such.

Then, too, a few highly successful companies have prospered by selling direct from factory to consumer, while others have sold exclusively imported products, also on a direct-to-customer basis. Thus the ham has continued to avail himself of a wide choice of quality products at an equally wide choice of price range and source of supply. The demand has continued to dictate the supply.

Now, for the first time, a drastic reversal of the normal factory-to-distributor-to-customer trend has taken place. A major manufacturer who has sold exclusively through distributors for the past ten years has suddenly announced a new factory-to-user program. The purpose of this program is obvious; in order to compete on an even-price basis with the high quality products being imported, this manufacturer has felt the need to sell direct simply to maintain his place in the marketplace. Interestingly enough, he has also had the foresight to recognize that the individual distributors also have a vital stake in the ham business and must be considered. These distributors provide vital services in several areas, not the least of which is the trading of used equipment. In addition, the distributor provides the opportunity for financing, as well as the opportunity for the customer to see and often to operate equipment before purchasing it. Then too, this same distributor is available to handle any minor service problems that might arise. Thus, the new program makes provisions to include the distributor as well. Whether this program will be successful only time will tell, but it must certainly be recognized as a major change in marketing approach.

At any rate, we feel that the healthy competitive battle for sales that's taking place is going to be very good for ham radio. In the strict tradition of the American system of free enterprise it will offer hams a choice of quality products at competitive prices and this, we feel, is just fine.

OUR READERS SAY

CB on 220 mc

Editor, *CQ:*

In today's increasingly technical society, it is natural and proper that the mass of the citizenry should develop an increased awareness and surface understanding of technical matters. It is not necessarily true that the mass of the citizenry should delve deeply into technical matters as an amateur must, no more than a person need know how to overhaul an automobile in order to drive one. So, it is natural that increased numbers of the citizenry should come upon an interest in radio without the need to study as deeply as an amateur.

Since it is, in the final analysis, the mass of the citizenry which pays the bills making our government and society possible, it seems only fair that the government should make some effort to provide a radio service open to them. The existing Citizen's Band was an effort in that direction, but, due to the "skip" which often exists at 27 mc, the service got out of hand.

Experience and history have shown that whenever a government or group of people is unreasonably selfish with something that the mass of the people want, the people will sooner or later take the law into their own hands to get it. I have heard, since September, several cases in which a CB operator, with no fear of being stopped, had evidently obtained a high-powered ham rig (I have name brands on file mentioned on the air) and was operating bootleg-fashion on 10 meters. One of these was down on 15.

If the amateurs in this country want to be really honest, I feel they should back the proposed 220 mc code-free service, not oppose it, on the following grounds:

1. 220 mc is not used as much as 2 meters, and could be offered either "free" or *perhaps in exchange for return of the 11 meter band.* This would be logical as today's sideband could make more use of this narrow band than the a.m. of the 1950's was when we lost it.

2. A true "ham" is not selfish, and should realize that the ordinary citizen who *is* helping pay the bills, *does* deserve *somewhere* to operate more effectively than on 27 mc.

3. Experience has shown that the present Citizen's Band is out of control. Its use for pleasure is not immoral or an unreasonable thing to allow the ordinary citizen. But, under law, it *is* illegal and it *is* teaching the CB'er that he can break the law and get away with it if he considers the law too restrictive. Bottle up the CB'ers too long due to our own selfishness and they will start breaking into the 10 meter and perhaps lower bands in larger numbers than I have already witnessed. Should this happen in sufficient numbers, control of the lower bands could be rapidly lost. It is even conceivable that in such an event, the FCC, rightly alarmed might set upon a crackdown, could make use of radio by *all* private citizens, regardless of code or technical examinations, a thing of the past. Far fetched, perhaps. But so was the lunar landing until it happened.

In other words, make 220 mc CB legal before it is too late. Is this proposal, if backed by the amateurs, akin to an appeasement policy Chamberlain style? Not at all. Chamberlain was a misinformed man giving in to an enemy. Giving part of 220 mc to CB would be fellow citizens rightfully sharing something of value with other fellow citizens.

How often have *you* been on 220 mc anyway? If you *are* on 220 mc, don't you have other frequencies available for use? Don't be a push-over for this proposal. Don't be selfish, either. Just try to be understanding and fair, and reason will prevail.

David P. Smith, K9UIM
Olney, Illinois

The "Numbers Game"

Editor, *CQ:*

Upon re-reading the December issue of *CQ,* I again read the letter from Howard F. Anderson suggesting a listing of equipment and the use and manufacturer thereof.

He suggests that would be of interest to the beginner. Believe me, it would help the "Ole Timer" who has other facts besides radio equipment to memorize. I mean, such facts as pertain to his particular profession or business.

When someone tells me he is using an XY427, or some other gear, which I probably never heard of. How many remember the obsolete BC-410 and the BC-348? Of course you never hear of those any more because they became obsolete with the coming of TV.

My suggestion would be to publish a list of any equipment made in the last ten years, giving the manufacturer's name, the use, and, if it is a transmitter, the power input. Leave room to add new equipment as it reaches the market. Put it in pamphlet form and offer it for sale. I'll venture to say you would find a ready market for such a publication.

George G. Postels, W9SA
Middleton, WI

Defense of C.W.

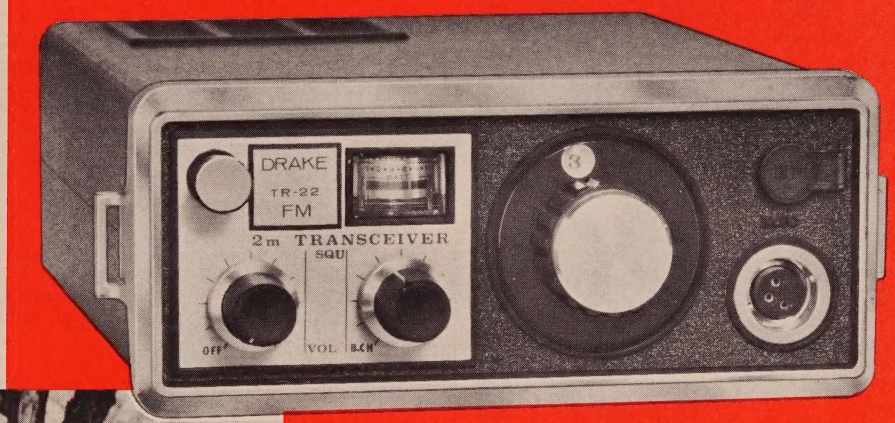
Editor, *CQ:*

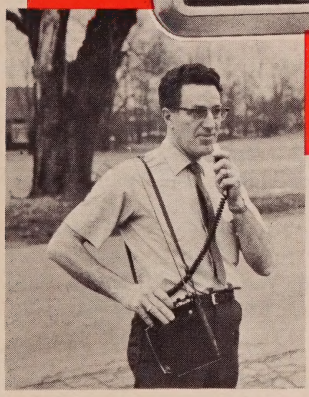
I read the article, "In Defense of CW" by William Ryburn in the December issue. The points in favor of c.w. were well made. Many of us, who pounded brass in the Navy can attest to the superior traffic handling ability of code.

Although, as the author mentions, other methods exist that are faster and require less skill, the former is not true of radiophone and the latter does not apply to amateur radio because all hams are required to be proficient c.w. operators anyway. C.w.—even at 10 w.p.m.—can be faster than

Versatility plus!...in a
2 Meter FM Transceiver

. . . IN THE FIELD
IN THE CAR
IN THE HOME . . .





DRAKE MODEL TR-22

$199.95 Amateur Net*

The TR-22 is a 2-meter VHF-FM completely transistorized, compact, portable transceiver with capacity for six channels. It can be used over the shoulder, mobile, or in your home. Has a built-in telescoping antenna, and SO-239 connector provided for external antenna. May be used barefoot or with accessory two-way amplifier. Operates on external 12 VDC or on internal rechargeable nickel-cadmium batteries. Has built-in 120 VAC 50-60 Hz battery charger.

SPECIFICATIONS

GENERAL • **Frequency Coverage:** 144-148 MHz • **6 channels, 3 supplied: (1)** Rcv: 146.94 MHz, Xmit: 146.34 MHz; **(2)** Simplex: 146.94 MHz; **(3)** Rcv: 146.76 MHz, Xmit: 146.34 MHz • **Frequency modulation** • **Push-to-talk** Xmtr Control • **DC Power Drain:** Rcv: 45 mA, Xmit: 450 mA • **Power Source:** 12 VDC ± 20%; 120 VAC 50-60 Hz (for recharging nickel cadmium batteries only.) • **Size:** 5⅜″ x 2 5/16″ x 7⅛″, **Wt:** 3¾ lbs.

RECEIVER • **Completely transistorized** crystal controlled double conversion superheterodyne circuit. • **1st IF** 10.7 MHz • **2nd IF** 455 KHz • **Antenna Input Impedance:** 50 ohms • **Sensitivity:** 1 microvolt or less for 20 dB S+N/N ratio • **Audio Output:** 0.7 watt at 10% or less distortion • **Built-in speaker.**

TRANSMITTER • **RF Output Power** over 1 watt • **Frequency Deviation** adjustable to 15 kHz maximum; factory set to 5 kHz.

***PRICE OF TR-22 INCLUDES:** Dynamic Microphone, Over-the-Shoulder Carrying Case, 120 VAC and 12 VDC Power Cords, Speaker/Headphone Plug, and 10 Nickel-Cadmium Batteries.

Model AA-22 Accessory Amplifier $149.95. Improves receiver sensitivity and rejection of undesired signals. Provides at least 25 watts output with ½ to 3 watts drive. Fully automatic.

Model MNK-22 Mobile Mount for TR-22 **$6.95**

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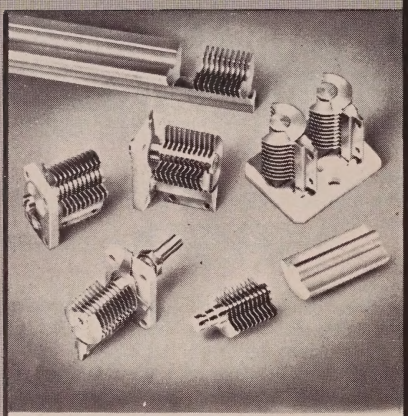
Designed for



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HIGH Q MINIATURE
VARIABLE AIR CAPACITORS

High Q at high frequencies. Rotors and Stators precision machined from extruded solid brass. Terminal integral part of Stator block. Shaft an integral part of Rotor. Screw-driver slot adjustment or 1/8" extended shaft for knob. Only 6 parts to a complete Capacitor. Stock sizes 15, 25 & 35 mmfd. single or dual units.

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MAIN OFFICE AND FACTORY
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Application

phone when the sending operator must often spell out words phonetically and the receiving operator must repeat back the text for verification.

Why then, one might ask, are so many "emergency nets" on the ham bands still using phone?

Lawrence F. Marinaccio, W3TTG
Wampum, Pa.

FM Column

Editor, *CQ:*

Let me express my thanks for your new section, "FM Column," in the January 1971 issue.

This is a most interesting phase of amateur radio and your Mr. Zook is a fine choice of editor. I have studied his writings and found he knows what he is writing about. I shall look forward to his part in coming issues of *CQ* magazine.

Wilbur T. Golson, W5CD
Baton Rouge, La.

W5CD's letter is typical of dozens received in response to the new f.m. department. F.m. enthusiasts can look forward to continued coverage of the f.m. scene in this and all future issues of *CQ*.—Ed.

[continued on page 126]

Announcements

Cuyahoga Falls, Ohio

The Cuyahoga Falls Radio Club announces their annual auction to be held Friday, February 26, at the Lincoln School, 3131 Bailey Rd., Cuyahoga Falls, Ohio (same place as last year). For further information contact Frank Stannard, WA8RBI, Cuyahoga Falls Radio Club, P.O. Box 106, Cuyahoya Falls, Ohio 44222.

Darmstadt, Germany

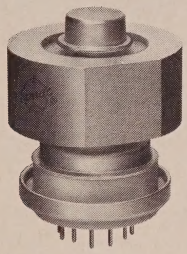
We have been advised that a new organization, GARTG (German Amateur Radio Teletype Group) was formed in early October 1970. The group's aim, through their publication *RTTY*, is to encourage and foster greater interest in RTTY operations. They welcome members from foreign countries as well as Germans themselves. For complete details on the GARTG write to Uli Stolz, DJ9XBA, Darmstrasse 26, D-6100 Darmstadt, Germany.

Columbus, Georgia

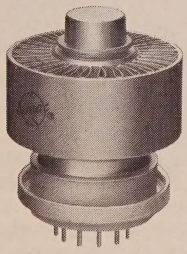
The annual Columbus, Georgia hamfest will be held on March 21st at the Fine Arts Building behind the Municipal Auditorium at the Fairgrounds. For information, write John Laney, K4VGI, 1905 Iris Drive, Columbus, Georgia 31906.

EIMAC's new 8873 family covers the electromagnetic spectrum from DC to 500 MHz.

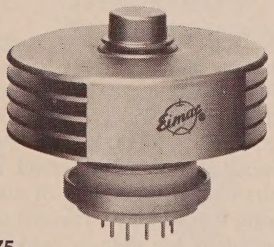
No need to compartmentalize your thinking when you contemplate EIMAC's new 8873 family of zero bias triodes. This tube for all seasons has three interesting configurations that allow you unprecedented design freedom: conduction cooling to heat sink (8873), axial cooling (8874) and transverse cooling (8875). Your choice to overcome today's design constrictions.



8873
CONDUCTION COOLED
ANODE



8874
AXIAL COOLED
ANODE



8875
TRANSVERSE COOLED
ANODE

Consider that the 8873 family provides up to 1000 watts PEP input or 500 watts continuous duty input per tube to 500 MHz. Low grid interception allows low drive power to be combined with low intermodulation distortion in linear service.

Observe that while the 8873 family performs in superior fashion as a linear amplifier in SSB service, it is also ideally suited for high gain, class-C FM or AM service in the VHF/UHF range. Electron control by EIMAC's new segmented, self-focusing cathode and unique aligned grid structure provide the key to this improved performance. The grid, moreover, is terminated in a low inductance contact ring about the base of the tube, permitting very effective intra-stage isolation to be achieved up to the outer frequency limit of operation.

Note that these rugged triodes are exceptionally well suited for class-B audio service as well as for pulse operation demanding high peak current capability at modest drive power.

Remember the 8873 family of triodes covers the electromagnetic spectrum from DC to UHF with ease, meeting widely divergent requirements in a package you can hold in the palm of your hand. Use these compact tubes in table-top design where space is a scarce commodity or where high density packaging is imperative.

Write EIMAC today for details and circuitry on the 8873 family of grounded grid triode tubes. Another example of EIMAC's ability to provide tomorrow's tubes today. EIMAC, 301 Industrial Way, San Carlos, California 94070. Phone (415) 592-1221.

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VSWR GUARANTEE of 1.5/1 or better

Celebrating Our 25th Year! Mosley Electronics, Inc. takes pride in introducing an Anniversary-Special . . . The new "Rode-Master", featuring a GUARANTEE of an adjustable VSWR of 1.5/1 or better at any given frequency on each band.

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Mosley Electronics, Inc.

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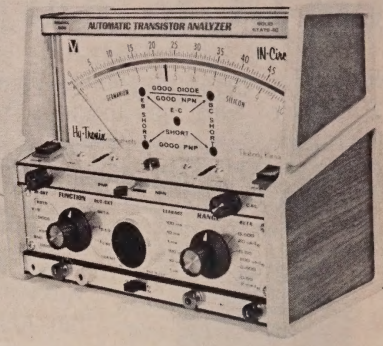
New Amateur Products



Vanguard Automatic Transistor Analyzer

USING an eight inch, linear, mirrored, anti-parallax scaled meter, this solid state automatic analyzer measures beta directly and leakage to the nearest nanoamp. Designed for in and out of circuit, and shunted down to 270 ohms; it automatically differentiates between PNP and NPN, will indicate silicon or germanium, and dynamically tests to go-nogo parameters of transistors and diodes giving qualitative visual and/or aural read-out. Operates on 115/230 volts, weighs 6¾ lbs, packaged in a rugged metal case 7⅞"W x 4½D x 7"H. Price $287.00 (less Model 103 probe $15.00). For complete specs write to Vanguard Electronic Tools, Inc., Hy-Tronix Instruments Div., P. O. Box 667, Newton, Kansas 67114, or circle 83 on Reader Service coupon.

Global Data Desk Pad

THE GRS Data Desk Pad is made of rugged vinyl and measures 19½ × 13⅛". Data sheets slip into the pocket across the top and corner tabs at the bottom. Twenty sheets are supplied with each pad. Each sheet shows the band allocations and includes a quick log form that permits neat organization of notes before transferring them to a permanent station log. All pertinent log data is provided for in ruled columns. The Data Desk Pad sells for $4.75. More information on the pad can be had by writing to Global Research & Supplies, P.O. Box 271B, Lombard, Ill. 60148 or circling 78 on Reader Service coupon.

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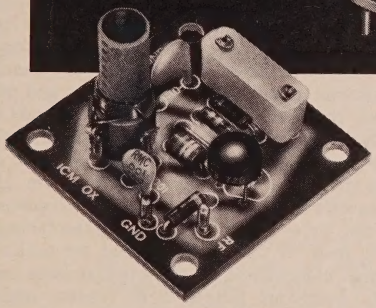
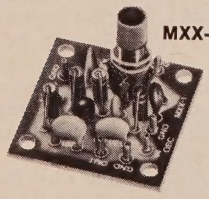


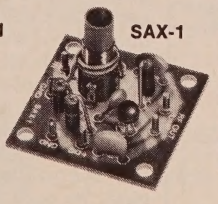
OX OSCILLATOR

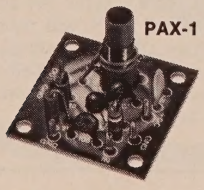
Crystal controlled transistor type.
Lo Kit 3,000 to 19,999 KHz
Hi Kit 20,000 to 60,000 KHz
(Specify when ordering)

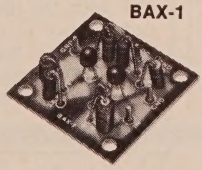
$2.95

MXX-1 Transistor RF Mixer **$3.50**
A single tuned circuit intended for signal conversion in the 3 to 170 MHz range. Harmonics of the OX oscillator are used for injection in the 60 to 170 MHz range.
Lo Kit 3 to 20 MHz
Hi Kit 20 to 170 MHz
(Specify when ordering)









SAX-1 Transistor RF Amplifier **$3.50**
A small signal amplifier to drive MXX-1 mixer. Single tuned input and link output.
Lo Kit 3 to 20 MHz
Hi Kit 20 to 170 MHz
(Specify when ordering)

PAX-1 Transistor RF Power Amplifier **$3.75**
A single tuned output amplifier designed to follow the OX oscillator. Outputs up to 200 mw can be obtained depending on the frequency and voltage. Amplifier can be amplitude modulated for low power communication. Frequency range 3,000 to 30,000 KHz.

BAX-1 Broadband Amplifier **$3.75**
General purpose unit which may be used as a tuned or untuned amplifier in RF and audio applications 20 Hz to 150 MHz. Provides 6 to 30 db gain. Ideal for SWL, Experimenter or Amateur.

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New PS88 all-screwdriver set rounds out Xcelite's popular, compact convertible tool set line. Handy midgets do double duty when slipped into remarkable hollow "piggyback" torque amplifier handle which provides the grip, reach and power of standard drivers. Each set in a slim, trim, see-thru plastic pocket case, also usable as bench stand.

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screwdrivers

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2 slot tip,
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from the Publisher

Please forgive our suspicious nature, but our delicately tuned nostrils detect a long-dead skunk about to be resurrected. Well, maybe that's a bit too strong, so we'll just spell out our hunch in detail and let our readers judge for themselves.

Some years ago our worthy competitor up at *73 Magazine* decided that there was a need for another national ham radio organization to accomplish many things that he, in his supreme wisdom, had decided were necessary for our hobby. This organization was founded by W2NSD and was called the Institute of Amateur Radio or IoAR for short. Many thousands of dollars found their way into the Institute coffers at New Hampshire, but somehow the organization never quite got off the ground. To our knowledge, no accounting of the money collected was ever made to the members-at-large, nor was any itemization of expenses or financial status ever published. For all intents and purposes, the IoAR simply tapped thousands of dollars from well-intentioned hams who thought they were supporting a worthwhile cause. At least that's the way it appears from here, and we haven't seen anything to change this opinion.

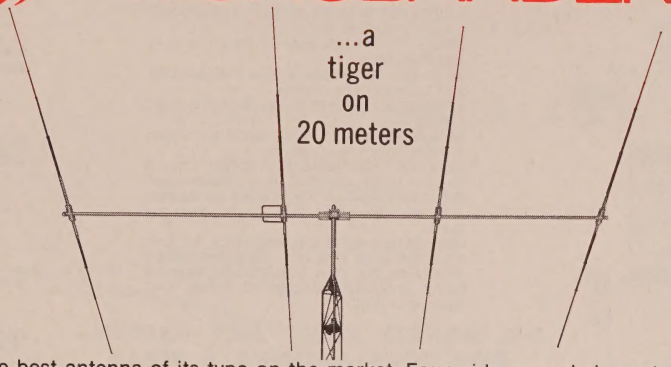
Now, we've just finished reading the January, 1971 issue of *73 Magazine,* and we notice a strange coincidence. This particular issue contains numerous letters from readers urging Wayne to start and run a new national organization, which leaves us with the uncomfortable feeling in the pit of our stomach that in another month or so we'll be reading in *73* that Mr. Green has, by popular demand, consented to resurrect IoAR for the good and welfare of amateur radio.

There are many thousands of amateurs who, having been stung once, will shy from temptation. But we wonder with a good deal of concern, how many others, well-intentioned and sincere though they may be, will be unfamiliar with the cloudy history of IoAR, and will allow themselves to contribute hard-earned dollars to the mysterious bottomless pit. Unfortunately, a number of the ardent *73* supporters who will be tempted in this direction do not normally read *CQ or QST* and will not be aware of what has transpired. We hope that those of you who are familiar with the history of IoAR will make the facts known to others at club meetings, hamfests, and on the air. We've had a bellyful of watching sincere hams being taken, and we hope that you feel as we do.

—WA2LRO

for the most advanced antennas under the sun!

HY-GAIN 204BA MONOBANDER



The best antenna of its type on the market. Four wide spaced elements (the longest 36'6") on a 26' boom along with Hy-Gain's exclusive Beta Match produce a high performance DX beam for phone or CW across the entire 20 meter band.

- 10 db forward gain
- 28 db F/B ratio
- Less than 1.05:1 SWR at resonance
- Feeds with 52 ohm coax
- Maximum power input 1 kw AM; 4 kw PEP
- Wind load 99.8 lbs. at 80 MPH
- Surface area 3.9 sq. ft.

The 204BA Monobander is ruggedly built to insure mechanical as well as electrical reliability, yet light enough to mount on a lightweight tower. (Recommended rotator: Hy-Gain's new Roto-Brake 400.) Construction features include taper swaged slotted tubing with full circumference clamps; tiltable cast aluminum boom-to-mast clamp; heavy gauge machine formed element-to-boom brackets; boom 2" OD; mast diameters from 1½" to 2½"; wind survival up to 100 MPH. Shipping weight 51 pounds.

See the best distributor under the sun...the one who handles the Hy-Gain 204BA Monobander.

Model 204BA (4-element, 20 meters).....**$149.95**
Model 203BA (3-element, 20 meters).....**$139.95**
Model 153BA (3-element, 15 meters).....**$ 69.95**
Model 103BA (3-element, 10 meters).....**$ 54.95**

FERRITE BALUN MODEL BN-86

Improves transfer of energy to the antenna; eliminates stray RF; improves pattern and F/B ratio. **$14.95**

HY-GAIN ELECTRONICS CORPORATION

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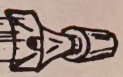

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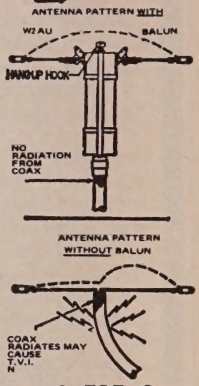
NOW BEING USED EXTENSIVELY BY ALL BRANCHES OF THE U. S. ARMED FORCES, FAA, RCA, FCC, CIA, CANADIAN DEFENSE DEPT. PLUS THOUSANDS OF HAMS THE WORLD OVER.



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***BIG SIGNALS* DON'T JUST HAPPEN– GIVE YOUR ANTENNA A BREAK**

Comes in 2 models. 1:1 matches 50 or 75 ohm unbalanced (coax line) to 50 or 75 ohm balanced load. 4:1 model matches 50 or 75 ohm unbalanced (coax line) to 200 or 300 ohm balanced load.

AVAILABLE AT ALL LEADING DEALERS. IF NOT, ORDER DIRECT

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Solid-State–Programable COMMUNICATIONS RECEIVER

The SPR-4 outperforms the best tube receiver, and has all advantages of solid state design . . . low power consumption, high stability and reliability.

Model SPR-4 Amateur Net **$499.95**

ACCESSORIES: Noise Blanker, 100 kHz Calibrator, MS-4 Speaker, AL-4 Loop Antenna for .15-1.5 MHz, Transceive Adaptor (T-4XB), DC Power Cord, Crystals.

PROGRAMABLE for any interest . . . SWL, Ham, lab, BC, marine, etc. • **Only FETs** in signal path • **Linear VFO** with 1 kHz readout • **Covers 150-500 kHz plus any 23 ranges (500 kHz wide) .500-30 MHz** • **10 ranges furnished,** others $5.00 each • **Coverage easily changed** • **3 band-widths:** 0.4, 2.4 and 4.8 kHz for CW, SSB and AM • **Built-in spkr** • **Notch filter** • **115 or 220 VAC, or 12 VDC** • **Dimens:** 10¾" W x 5½" H x 12¼" D, **Wt.** 14 lbs.

Available at your local distributor.

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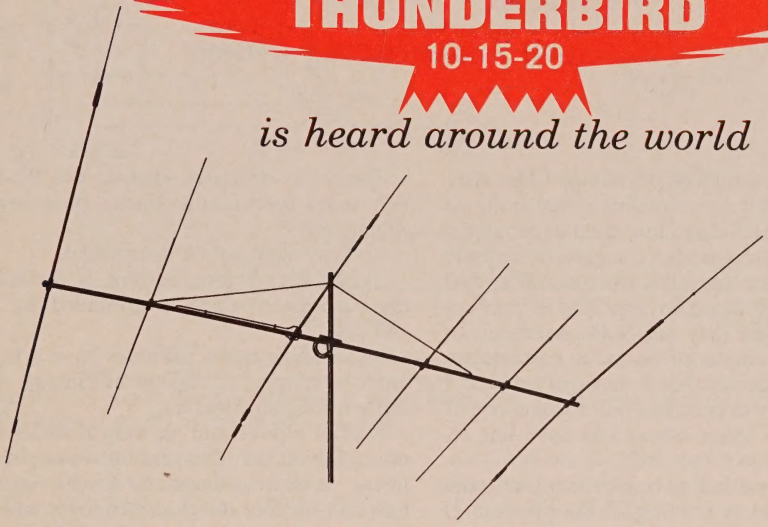
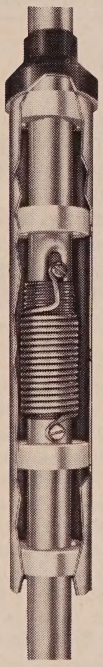
HY-GAIN'S
THUNDERBIRD
10-15-20

is heard around the world





Here's why Thunderbirds outperform all other tri-banders:

* **Thunderbird's "Hy-Q" traps** provide separate traps for each band. "Hy-Q" traps are electronically tuned at the factory to perform better at any frequency in the band—either phone or CW. **And** you can tune the antenna, using charts supplied in the manual, to **substantially** outperform any other antennas made.
* **Thunderbird's superior construction** includes a new, cast aluminum, tilt-head universal boom-to-mast bracket that accommodates masts from 1¼" x 2½". Allows easy tilting for installation, maintenance and tuning and provides mast feed-thru for beam stacking.

  Taper swaged, slotted tubing on all elements allows easy adjustment and readjustment. Taper swaged to permit larger diameter tubing where it counts! And less wind loading. Full circumference compression clamps are mechanically and electrically superior to self-tapping metal screws.
* **Thunderbird's exclusive Beta Match** achieves balanced input, optimum matching on all 3 bands and provides DC ground to eliminate precipitation static.
* Up to 9.5 db forward gain.
* 25 db front-to-back ratio.
* SWR less than 1.5 to 1 on all bands.
* 24-foot boom...none longer in the industry.
* Extra heavy gauge, machine formed, element to boom brackets, with plastic sleeves used only for insulation. Bracket design allows full mechanical support.
* Interlaced, optimum spaced elements for higher gain and better pattern control.
* 3 active elements on 20 and 15 meters. 4 active elements on 10 meters.

New 6-Element Super Thunderbird
Model 389
Suggested retail price, **$179.95**

Improved 3-Element Thunderbird
Model 388
Suggested retail price, **$144.95**

Fabulous 3-Element Thunderbird, Jr.
Model 221
Suggested retail price, **$99.95**

Popular 2-Element Thunderbird
Model 390
Suggested retail price, **$99.95**

Buy one today at your favorite Hy-Gain distributor!

HY-GAIN ELECTRONICS CORPORATION

P.O. Box 5407-FC, Lincoln, Nebraska 68505

A 500 Watt 2 Meter Linear Using Pentodes

BY RALPH W. CAMPBELL,* W4KAE

BUILDING a high performance Class AB1 linear amplifier for 2 meters is not quite as simple as it is for the low frequency bands. Most of the designs seen use glass or ceramic external anode tetrodes, not pentodes, and tetrodes are difficult to use. This is particularly true when they are in the hands of inexperienced amateurs. So much can happen with a tetrode rig that is unexpected that I switched over to pentodes (after losing one of the 4CX250 series tubes) and have not regretted it.

The major disadvantage of using tetrodes is not too widely publicized: the problem of negative screen current. Negative screen current can occur with any tetrode, especially in large signal and power circuits. The negative screen current (which doesn't necessarily show on a meter) is most pronounced when the grids are "back heated" by v.h.f. energy.

Another factor to consider is that tetrodes have to be neutralized. Also, pentodes and tetrodes have the same high input capacitance and so require about the same drive; the pentode, however, will deliver more output for the same drive.

*316 Mariemont Dr., Lexington, Ky.

The v.h.f. pentodes, such as the PL-177-WA tubes used in this linear, have several advantages.

1—They need not be neutralized.

2—Negative screen current is limited by the suppressor which is grounded for d.c. and r.f.

3—R.f.-type beam pentodes have a higher output capacity, a definite advantage when series tuning on 2 meters.

Special blower and air system sockets are not required for the pentodes used in this linear. A Barber-Coleman 4" fan is used, however, to cool the glass envelopes and also to keep the heat down in the coupling capacitor.

Screen Regulation

Designing the linear with pentodes rated for v.h.f. service permits easier stabilization of the screen grid current and voltage. The screen voltage is obtained from *two* sources, a shunt bled screen power supply (fig. 1) and a series dropping resistor from the high voltage source. This approach provides increased "stiffness" or stability that permits constant output over moderate periods of key down operation.

An overall view of the 500 watt linear in its case. Both PL-177WA tubes are mounted on conventional Johnson septar sockets without chimneys. A Barber-Colman transverse blower delivers 190 c.f.m. to cool the pentodes and blocking capacitor. (A 3" fan is shown here but was changed later to a 4" model.) The controls on the front are from left to right; grid input, grid tuning, power on-off, power indicator, filament indicator and filament fuse.

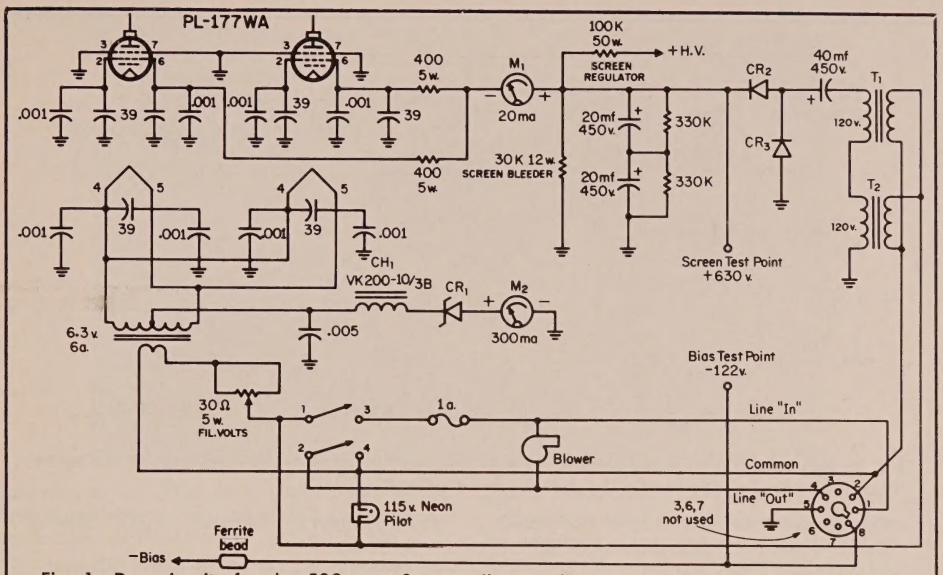


Fig. 1—D.c. circuits for the 500 watt 2 meter linear. The power plug connects to the Heath HP-24 power supply as described in the text.

CH_1—Ferroxcube VK200-10/3B.
CR_1—18 volt 10 watt zener diode.
CR_2, CR_3—Silicon diodes, 1000 p.i.v., 1 amp.
M_1—0-20 ma, Emico Model 13 or equiv.
M_2—0-300 ma, Emico Model 13 or equiv.
T_1, T_2—125 volt 50 ma.

The choice of the series screen regulator resistance value is based on a 5% increase in the screen voltage once the initial screen supply is providing the desired voltage with the plate voltage applied.

D.C. Circuitry

The circuit of the 500 watt 2 meter linear has been broken down into two sections, the d.c. and r.f. portions. Figure 1 shows the d.c. portion only. While the control grids and plates are shown in fig. 1, the related r.f. circuitry is omitted. The r.f. circuitry is given in detail in fig. 2.

The screen grid power supply uses two 1:1 isolation transformers with the secondaries in series to drive a half wave voltage doubler. (Be sure they are phased to add.) The power plug is fed from a Heathkit HP-24 kilowatt power supply formerly used on the low bands. The necessary changes will be covered shortly.

The bias line is decoupled by Ferroxcube or Amitron ferrite beads which are more efficient than the Ferroxcube VK-200-10/3B choke, CH_1. The choke finds use only in low impedance circuits such as the zener diode in the center tap of the filament transformer secondary.

The filament transformer is a 6.3 volt unit with a 6 amp rating. At 6.3 volts the total filament drain would be 6.4 amps. The series pot in the primary drops the filament voltage to 6 volts and thus keeps within the current rating.

Use is made of series resonant bypassing around the septar ceramic wafer tube sockets. The 39 mmf disc capacitors are conveniently resonant in the 2 meter band (with the usual lead lengths) and provide a minimum impedance from the PL-177WA filaments and screen leads to ground. In addition to the 39 mmf capacitors, 0.001 mf capacitors are used for conventional bypassing.

It was not found necessary to locate all r.f. ground returns at a single point. Sensible placement yielded a good, stable design as shown in the photographs.

Two 400 ohm 5 watt wire wound resistors are placed in the screen circuit feeds to prevent one tube from hogging all the screen current and to provide decoupling.

Bias and screen potentials can be measured from test points located on the top of the

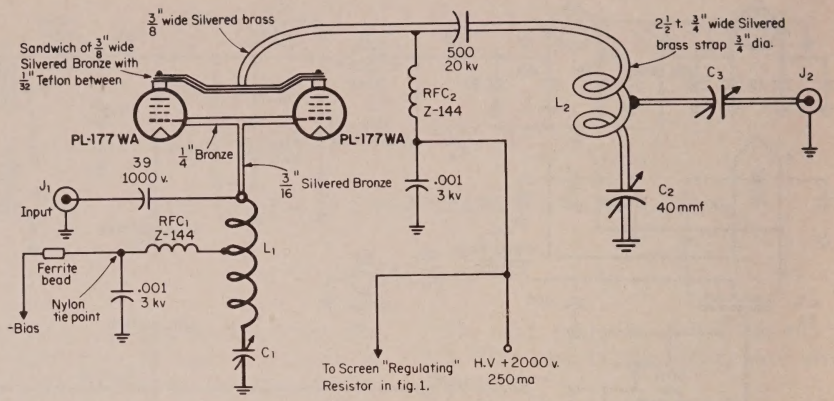


Fig. 2—R.f. circuitry for the 500 watt linear shows how the input and output circuits are series tuned. The high voltage feed is the center conductor of RG-59/U.

C_1—20 mmf. E.F. Johnson 20M11 or equiv.
C_2—E.F. Johnson capacitor modified as explained in the text.
C_3—Miller 160-E padder modified as described in the text.
L_1—4½ turns #14 Beldsol on 3/8" ceramic form, c.t.
L_2—2½ turns 3/4" wide heavy silvered brass stock.
RFC_1, RFC_2—Ohmite Z-144 r.f. chokes.

chassis. The screen voltage is 630 volts and is 5% higher than normal as explained earlier) under no-load conditions. This prevents sagging output. Screen and plate current are measured by permanently wired in meters.

Power Supply Modifications

The circuit of the Heath HP-24 power supply has not been shown as part of fig. 1. The connection is fairly simple requiring the addition of an extra wire to the power plug for the "Line Out." Switched "Line Input" and "Common" connections were already provided.

There is one small change in the power supply circuitry, however. The unused 12.6 volt a.c. secondary winding must be wired in series bucking with the primary in order to drop the high voltage output from 2,250 volts to 2,000 volts. This is necessary in order to stay within the anode voltage ratings of the PL-177WA's.

When the above modification is made the bias voltage also drops to about 122 volts. In order to restore the bias to the required 140 volts, the 18 volt zener diode is added in the filament circuit.

R.F. Grid Circuitry

The r.f. circuitry for the grid and plate is shown in fig. 2. At first, tuned lines were used but not found satisfactory. The efficiency was so low that they were changed to strap lines of brass with series tuning. The bronze used is about 5 mils thick and cut from a roll 2⅝" wide. The brass used in the plate circuit is commercial shim stock, 25 mils thick.

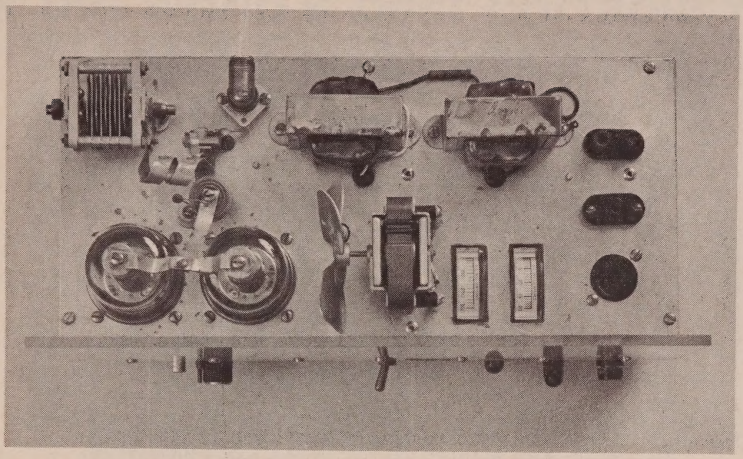
The input is coupled to the grid series-tuned circuit through heavy 39 mmf 1000 volt disc capacitor. The coil L_1 is made from 4½ turns of #14 Beldsol wire on a 3/8" diameter form series tuned by a Johnson 20 mmf capacitor.

Bias is fed to the center point (approximately) of the coil through a "tee" formed by an Ohmite Z-144 r.f. choke on one side and a ferrite bead on the other. The center leg is a 0.001 ceramic capacitor rated at 3 kv.

The r.f. connection from the coil to the two grids is made through a silvered length of 3/16" wide bronze stock to a 1/4" wide silvered bronze jumper that connects the grids. A close up of this is shown in the bottom view photo.

R.F. Plate Circuitry

Two Eimac HR-6 plate caps are used with the PL-177WA's. The two caps are connected with two straps of silver plated bronze separated by 1/32" Teflon sheet stock. The bronze-Teflon sandwich provides greater flexibility and adds enough thickness to permit easy connection to the 3/8" wide silver



Top view of the 500 watt 2 meter linear shows layout and view of the plate circuit r.f. components. The modified double ended Johnson variable with 9 plates can be seen in the upper left corner of the chassis. The bias screen Test Point jack is in the upper right section just above the high voltage connector. Below the connector is the plug that connects to the Heath HP-24 power supply. (For safety it should be a chassis mounted male plug.)

plated brass lead to the 500 mmf 20 kv doorknob capacitor. The Ohmite Z-144 r.f. choke connects to the brass strap at the capacitor terminal as shown in the photographs.

A 2½ turn plate inductance, L_2, is made of 3/4" silver plated brass strap. The diameter of the coiled strap is about 3/4 of an inch. At the mid point of L_2 a short strap is soldered to one lug of a two-plate compression variable capacitor, Miller 160-E. This variable is modified by the addition of mica insulation so that there are four sheets of mica over each surface area used. If this is not done, the capacitor will simply arc over.

The plate tuning capacitor is made from two Johnson type F variables (closest to type 155-8). The finished product should have 9 plates, about 40 mmf and a voltage rating of 3000 volts peak.

Construction

The chassis used for the PL-177WA linear is a Bud CU-712 Convertabox. It has the advantage of having a removable top and front apron for ease in working on it. The rear, side and bottom have been punched for standard 1 inch screened steel vent plugs. This is necessary to help cool many of the components underneath the chassis. The plugs have been soldered into the under structure with a Microflame gas welding torch.

The two tubes are recessed into the chassis through 2¼" holes. The sockets (Johnson #122-247-1) are mounted by #8 threaded brass rod. The clear plastic front protective plate is made from high impact polystyrene. The case is made of expanded aluminum mesh.

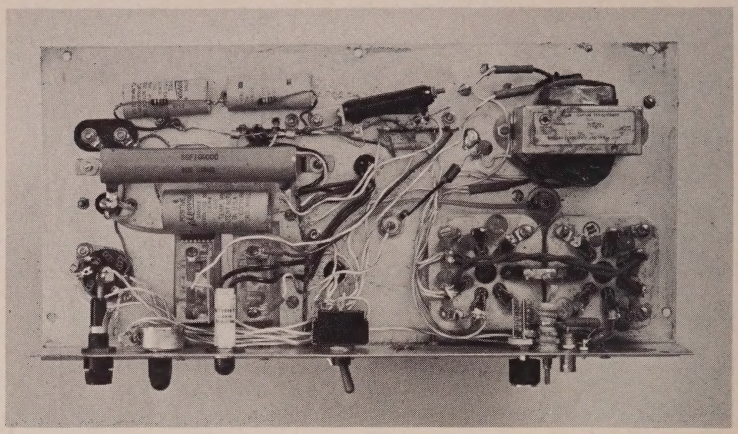
The input connector, J_1, is a UG-1094/U connector and is mounted on the front apron of the chassis. The output connector is a conventional SO-239 surface mounted on threaded brass rod so that connection can be made from C_3 to its center connector. A right angle adaptor is used to permit easy connection.

Alignment and Adjustment

The 500 watt linear is actually easy to adjust. While a Twoer can provide enough power to adjust the grid tank, it will not be adequate to drive the linear to its full power. The plate current should rise as the grid circuit is brought into resonance.

Peaking the plate circuit is a bit more involved because maximum output does not always correspond with minimum plate current. This is particularly true when the meter is also indicating screen current as is the case here.

Use a diode-type v.h.f. power monitor, preferably coupled with a one turn of coax loop with a Faraday screen and a hot carrier diode. Tune the plate tank for maximum output on the power meter.



Bottom view of the 500 watt 2 meter linear shows a relatively uncluttered assembly. The grid wiring shown in the lower right corner was later changed to that shown in fig. 2. The filament transformer is just above the tube sockets. The screen voltage doubler is in the left upper corner above the screen regulating resistor.

The driver used with the linear is an Ameco TX-62. Nothing more powerful than this, (75w.), should be used or the grids of the PL-177WA's will be pushed into the positive region.

With all voltage applied, but no drive, the PL-177WA's should indicate a quiescent plate current of 40 ma. The screen current will be about 5 ma. The screen voltage should read at least 600 volts and more likely 630 volts with the high voltage regulating resistor installed. The bias line will measure −122 volts.

Use a low power source such as the Twoer for the initial check up. Tune both the grid and the plate circuits as described above. Be sure that resonance is reached within the range of the tuning capacitors. Once this is checked the TX-62 (or whatever driver you are to use) may be connected to the input. Connect a wattmeter to the output and fire up.

Set up at the low end of the 2 meter band and tune the series coupling capacitor (C_3) for a peak output. Be sure you are within the range of C_2 for resonance. The loading capacitor, C_3, and the tuning capacitor, C_2, interact, so make sure you can still go through resonance.

There may be some instability if the aluminum mesh shield is not in place. Also don't try to correct for a mismatched antenna by adjusting the loading capacitor, C_3; this must be cleared up at the antenna.

If all checks okay, increase the drive. The plate of the pentodes should glow cherry red and the output at maximum. If the anodes run white hot, shut off the power and check the high voltage. Be sure that the 12 volt winding in the power supply is connected so that it *bucks*. If not, it will increase the plate voltage above 2,250 volts instead of lowering it to 2000 volts.

If everything is normal, you will be drawing 250 ma of plate current plus 15 ma of screen current. There will be no sagging of output power as long as the grid tank does not heat up.

Plate tuning will change slightly on long transmissions because the 20 kv doorknob capacitor is made of Hi-K material which has a high temperature coefficient. For this reason the 4" fan is *mandatory* for cooling both the tubes *and* the coupling capacitor.

There seemed to be one peculiarity when driving the linear with the TX-62. The tuning circuit for the 7984 output in the Ameco TX-62 driver interacts with the grid tuning of the linear. Changing the grid tuning will sometimes shift the plate settings of the 7984 but only slightly. Worse is the case where the plate tuning of the 7984 moves the peak setting of the grid circuit for the pentodes in the linear. The adjustments can be made with one hand on the driver plate control and the other on the linear grid until both are properly set.

Other than the slight interaction, using the

[*Continued on page 116*]

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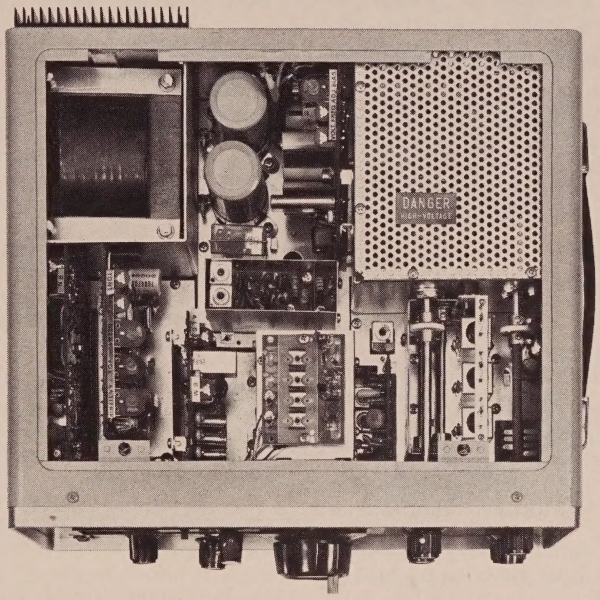

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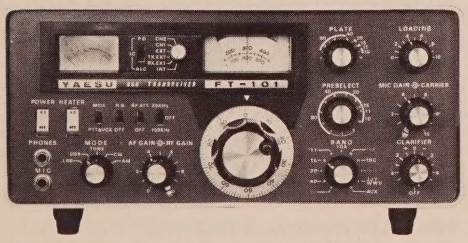

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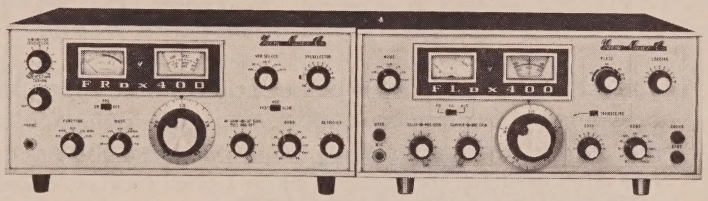

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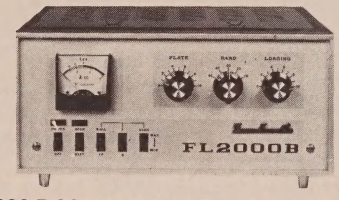
We rate the FLdx 400 very conservatively. That rating guarantees you 240 W PEP input SSB, 120 W CW and 75 W AM. The FSK option will go all day at a continuous 75 W. And you get full frequency coverage on all amateur bands — 80 meters through 10 meters — with an optional provision for certain other bands that you can personally specify. For all that, you pay just $299.95.



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VERSATILE USES OF TUNING DIODES

BY JOHN J. SCHULTZ, W2EEY

The use of tuning diodes in place of air variable capacitors allows a variety of tuning options that are almost impossible to duplicate with conventional mechanical linkage tuning systems. Now that the prices of tuning diodes are approaching the cost of plain signal diodes, amateurs may wish to take advantage of this component when constructing new pieces of equipment.

TUNING diodes—as they are presently being called instead of varactor diodes in order to distinguish them from varactor diodes intended for other application—are certainly not new components. The basics of their operation have been described before and it is not the purpose of this article to completely repeat such information. However, it has been only recently that a wide variety of such diodes that can match the performance of almost any air variable capacitor have become available at very reasonable prices. The air variable capacitor will probably be around for some time, but the frequency of its appearance in receiving equipment and low-power transmitter exciters is bound to be drastically reduced as it is replaced by the more versatile diode. Diodes can directly replace a bulky air variable capacitor and have none of the problems of noisiness (due to dust) and mechanical binding associated with the later. This article, however, does not deal primarily with the one-for-one substitution of an air variable capacitor by a tuning diode, although that subject is covered, but rather those features which can be achieved only with tuning diodes. The reader will undoubtedly be able to develop even more variations for the use of tuning diodes once the examples discussed are understood.

Basic Tuning Diode Usage

Figure 1 shows the basic one-for-one substitution of an air variable capacitor by a tuning diode. The diode is back-biased (hence it draws essentially no current) and as the magnitude of the back-bias voltage is increased, the depletion region between the PN junction of the diode increases. The effect is as though two capacitor plates were being drawn further apart and so as the magnitude of the voltage increases, the capacitance decreases.

In order to directly substitute a tuning diode for an air variable capacitor, the circuit has to be arranged such that the tuning diode capacitance variation duplicates that of the air-variable capacitor. This may mean that a series fixed capacitor and/or parallel fixed capacitor across the tuning diode may be necessary to modify the capacitance range of the tuning diode. Some sort of series capacitor is usually necessary anyway to act as a d.c. blocking capacitor for the tuning diode bias voltage. Other considerations involve choosing a diode with a sufficient breakdown voltage—in the same manner that the voltage rating of an air variable capacitor is determined—and with adequate Q. The latter is usually no problem with modern diodes as

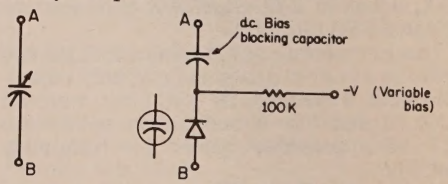

Fig. 1—Simple one for one substitution of air variable capacitor with a tuning diode (voltage variable capacitor diode) network is possible in some circuits. In other cases, series or parallel capacitors must be used with tuning diode to "tailor" its characteristics.

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The complete Yaesu story is a long one. So we've compiled a comprehensive information packet that gives you the complete picture. Including things like comparative detail photos, a schematic, and a comparison chart that shows you the FTdx 560's superiority over rigs you're more familiar with. Once you've looked over the FTdx 560 literature we think you'll agree that the amateur operator's impossible dream has become an incredible fact.

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MV 2103	10.0	400	2.9
MV 2104	12.0	400	2.9
MV 2105	15.0	400	2.9
MV 2106	18.0	350	2.9
MV 2107	22.0	350	2.9
MV 2108	27.0	200	3.0
MV 2109	33.0	200	3.0
MV 2110	39.0	150	3.0
MV 2111	47.0	150	3.0
MV 2112	56.0	150	3.0
MV 2113	68.0	150	3.0
MV 2114	82.0	100	3.0
MV 2115	100.0	100	3.0

Fig. 2—The Motorola "Epicap" series is a new series of low priced tuning diodes designed for use in receiver tuning circuits. Other diodes with different capacitance values, capacitance ratios, etc. are available from a variety of manufacturers such as Eastron, TRW, Hughes, etc.

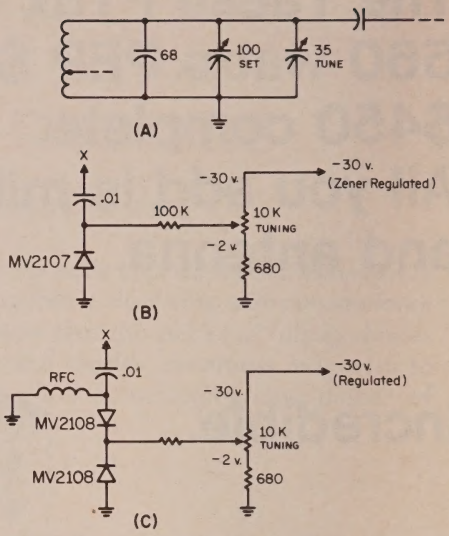

Fig. 3—Some examples of how tuning diodes can replace the tuning capacitor in a v.f.o. (A). Circuit at (B) provides about a 22-58 mmf tuning range while series circuit at (C) provides about 10-40 mmf tuning range.

many of them have *Q*'s which even exceed that of the usual air variable capacitor (about 150 to 250). Also, the *Q* in the case of tuning diodes does not show the great variation that can take place with an air variable capacitor depending upon its setting.

The one great disadvantage of inexpensive tuning diodes, such as the Motorola series shown in fig. 2 which sell for about a dollar, is that the capacitance ratio is limited to a factor of about 3, whereas air variable capacitors may have a minimum to maximum capacitance ratio of 1 to 20. More expensive tuning diodes are certainly available but the capacitance ratio rarely exceeds 1 to 10.

The limited capacitance ratio of tuning diodes is not too much of a practical drawback for most amateur applications, however, since it is usually desired to only tune circuits over one amateur band or a portion thereof. Figure 3 shows a simple example where the 35 mmf tuning capacitor for a v.f.o. is replaced by a tuning diode. Figure 3(B) shows the capacitor replaced directly by a tuning diode which shows the same capacitance variation—35 mmf—but with different minimum and maximum capacitance values. Normally, readjustment of the 100 mmf "set" capacitor will compensate for the different range of the tuning diode. If it is desired to bring the tuning diode range closer to that of the air variable capacitor, a series arrangement of two tuning diodes can be used as shown in fig. 3(C). Various diodes can be used in this arrangement. The ones shown will provide a capacitance range together of about 10 to 40 mmf.

If more than one air variable capacitor is being replaced, such as a ganged type, one tuning diode and 100K isolating resistor is used for each section. The 100K resistors are all connected to a single tuning potentiometer. As in the case of ganged air variable capacitors, separate trim capacitors are needed if one wants to exactly balance the capacitance of each section. This can be done in the case of tuning diodes by continuing to use small air-variable capacitors for this purpose or by extra tuning diodes as trimmers with separate PC board type adjustment potentiometer.

Expanding and Restricting the Tuning Scale

Once a tuning diode has been used to replace an air variable capacitor, the potentiometer for the tuning diode becomes the tuning control. One may use the same mechanical dial mechanism as before or some form of multi-turn potentiometer. One convenient option possible with a tuning diode is the ability to control the portion of the tuning scale that a given frequency will occupy. For instance, suppose that one rotation of a potentiometer causes a bias voltage of from 2 to

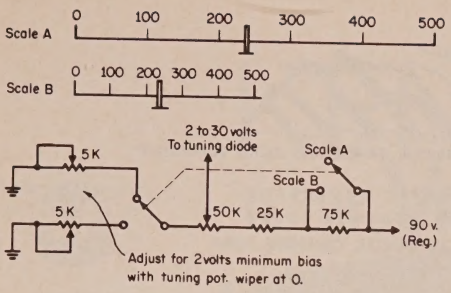

Fig. 4—If shaft of tuning potentiometer for a tuning diode is connected to a pointer and scale, various scales for expanded or contracted band coverage can be developed by simple changes in the diode bias circuit.

30 volts to be applied to a tuning diode which results in a capacitance variation to cover a given frequency range. As shown in fig. 4, the supply to the potentiometer can be switched such that the potentiometer supplies the same bias voltage range with only a half rotation. Thus, for quickly scanning a band for activity, one can contract the band on a tuning scale and expand it when one wants to do more selective tuning. Scale band calibrations can be made for one or more switch selected degrees of scale contraction or expansion. The minimum voltage supplied by the tuning potentiometer is adjusted by the 5K ohm potentiometers in fig. 4 so that it remains the same for any scale coverage option. Thus, the band calibration can always start at the same point on the scale. The only precaution to be observed with this method is that the breakdown voltage rating of the tuning diode is not exceeded. This could happen if the tuning potentiometer were inadvertently rotated too far when its total rotation could cause more that the breakdown voltage to appear across the diode. Such damage could be prevented by placing a zener diode rated below the tuning diode breakdown voltage from the potentiometer wiper arm to ground.

The change of capacitance of the diodes listed in fig. 2 is uniform with the variation in bias voltage. Thus, the use of a linear potentiometer will produce a fairly linear frequency-scale presentation. Such a situation may not always be desirable as one may wish to have one portion of a band cover most of a readout scale. Almost any desired portion of a band can be expanded by choosing a tuning potentiometer with the proper resistance taper. The number of such tapers which are available cannot all be covered here. Figure 5 illustrates a few common tapers and the resultant scale "spreads" that might result. Many other scale "spreads" can be developed by the use of different potentiometer tapers. One can also provide a switch selected option for different forms of scale "spreads" by using a dual or triple section potentiometer with each section having a different type of taper. The switch can then be used to select any desired potentiometer section to control the tuning diode.

Other variations on the above-described schemes include the use of a d.p.d.t. switch to "flip-over" the tuning scale by reversing the bias circuit connections to the tuning potentiometer's fixed resistance terminals. Thus, if one tuned from the low-end to the high-end of a band, one could "flip-over" the tuning scale to immediately return the tuning to start again at the low-end of the band. If a linear taper potentiometer is used with this arrangement the tuning scale is not only "flipped-over" but the expanded portion of the scale will be transferred to the opposite end of the band being covered (from the lower c.w. end of a band to the upper phone end of a band, for instance).

"Magnifying" the Tuning Scale

Another interesting tuning option possible with tuning diodes is the magnification or

[*Continued on page 122*]

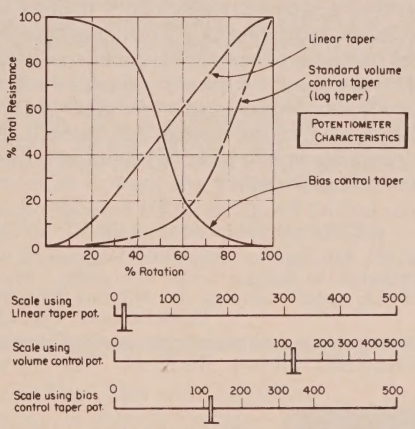

Fig. 5—If one uses a tuning diode which has uniform capacitance change with bias voltage and a linear bias-tuning potentiometer, a linear scale readout will result. However, by using a potentiometer with a special taper almost any scale "spread" desired may be developed. A few simple examples are shown.

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At Henry Radio we are proud of the long term contributions we have made to the well-being of the amateur fraternity in the United States and throughout the world. We believe that Henry Radio and other local amateur distributors are a vital ingredient in the continuing well-being of amateur radio. We are cognizant of the service we have always provided and will continue to provide. We believe your local distributor is also capable of making such a contribution.

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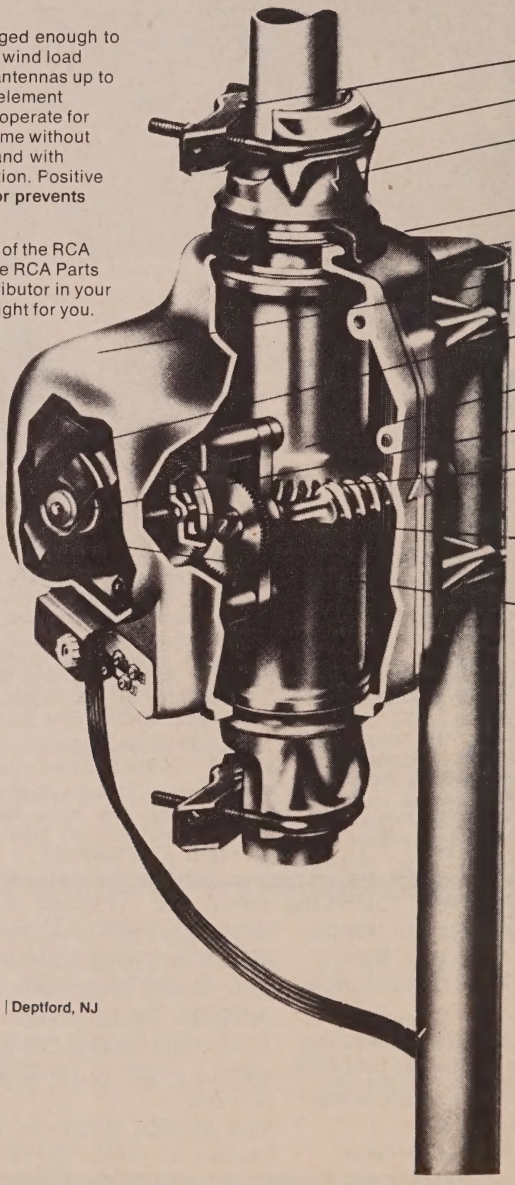

- V-block serrated clamping system locks mast securely.
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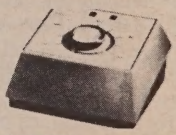

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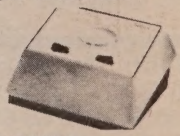

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Announcing

THE CQ WORLD WIDE WPX SSB CONTEST

March 27-28, 1971

I Contest Period: Starts: 0000 GMT Saturday. Ends: 2400 GMT Sunday. Only 30 hours of the 48 hour contest period permitted for Single Operator stations. The 18 hours of non-operating time may be taken in up to 5 periods anytime during the contest, and must be clearly indicated on the log. Multi-operator stations may operate the full 48 hours.

II Objective: Object of the contest is for amateurs around the world to contact as many amateurs in other parts of the world as possible during the contest period.

III Bands: All bands, 1.8 thru 28 mc may be used, but operation is confined to two-way single sideband *only*.

IV Type of Competition: 1. Single Operator (a) All Band, (b) Single Band. 2. Multi-operator, All Band, *only*. (a) Single Transmitter, (only one signal permitted) (b) Multi-Transmitter, (one signal per band permitted).

V Exchange: Five figure serial number, RS report plus a progressive three digit contact number starting with 001 for the first contact, (Continue to four digits if past a 1000) (Multi-Transmitter stations use separate numbers for each band.)

VI Points: 1. Contacts between stations on different continents; count 3 points on the 14, 21 and 28 mc bands, and 6 points on the 7, 3.5 and 1.8 mc bands.

2. Contacts between stations in the same continent but not in the same country; count 1 point on 14, 21 and 28 mc, and 2 points on 7, 3.5 and 1.8 mc. (Exception: Contacts between different North American countries count 2 points on 14, 21 and 28 mc, and 4 points on 7, 3.5 and 1.8 mc. This applies to North American countries *only*.)

3. Contacts are permitted between stations in the same country for the purpose of obtaining a Prefix multiplier, but have no QSO point value.

VII Multiplier: The multiplier is determined by the number of different prefixes worked.

A "prefix" is considered to be the two or three letter/number combination which forms the first part of an amateur call. (W1, W2, WA2, DL1, DJ, 4X4, 5A1 and etc. See WPX rules.)

Each prefix may be counted only *once* during the contest.

VIII Scoring: 1. Single Operator (a) All Band score, total QSO points from all bands multiplied by the number of different Prefixes worked. (b) Single Band score, QSO points on that band multiplied by the number of different Prefixes worked.

2. Multi-Operator stations. Scoring in both these categories is the same as the All Band scoring for Single Operator.

3. A station may be worked once on each band for QSO point credit. However, prefix credit can be taken only *once* regardless of the band.

IX Awards: Certificates will be awarded to the highest scoring station in each category listed under Sec. IV.

1. In every participating country.

2. In each call area of the United States, Canada and Australia.

All scores will be published. However to be eligible for an award, a Single Operator station must show a minimum of 12 hours of operation. Multi-operator stations must show a minimum of 24 hours.

A single band log is eligible for a single band award *only*. If a log contains more than one band it will be judged as an all band entry, unless specified otherwise. However a 12 hour minimum is required on the single band.

In countries or sections where the returns justify, 2nd and 3rd place awards will be made.

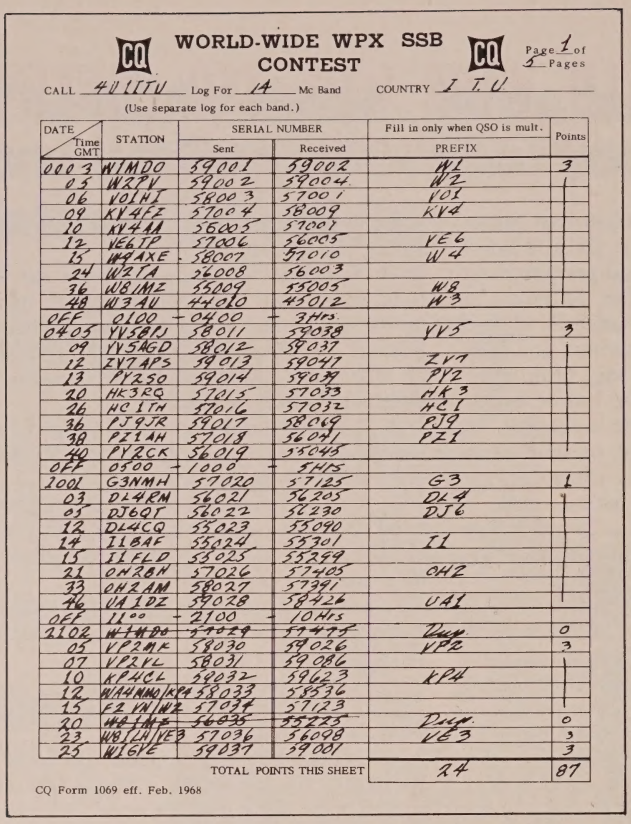
X Special Awards: 1. WORLD – Single Operator, Single Band. A trophy donated by Jack Chalk, KW6EJ.

2. WORLD–Single Operator. All Band. A Trophy donated by Don Murray, K4FMA.

3. WORLD–Multi-operator, single transmiter. The Ted Thorpe, ZL2AWJ Memorial Award, donated by Don Miller, W9WNV.

4. WORLD–Multi-operator, multi-transmiter, The Chuck Swain, K7LMU. Memorial Award, donated by Don Miller W9WNV.

5. CANADA – Single Operator, Single Band. A Trophy donated by Gene Krehbiel, VE6TP.



CQ WORLD-WIDE WPX SSB CONTEST CQ

Page 1 of 5 Pages

CALL 4U1ITU Log For 14 Mc Band COUNTRY I T U

(Use separate log for each band.)

DATE / Time GMT	STATION	SERIAL NUMBER Sent	SERIAL NUMBER Received	Fill in only when QSO is mult. PREFIX	Points
0003	WIMDO	59001	59002	WI	3
05	WR7V	59002	59004	W7	
06	VO1HI	58003	57001	VO1	
09	KV4FZ	57004	58009	KV4	
10	KV4AA	56005	57001		
12	VE6TP	57006	56005	VE6	
15	W4AXE	58007	57010	W4	
24	W2TA	56008	56003		
36	W8IMZ	55009	55005	W8	
48	W3AU	44010	45012	W3	
OFF	0100 - 0400 = 3Hrs.				
0403	YV5BIJ	58011	59038	YV5	3
09	YV5AGD	58012	59037		
12	ZV7APS	59013	58047	ZV7	
13	PY2SO	59014	58039	PY2	
20	HK3RQ	57015	57033	HK3	
26	HC1TH	57016	57032	HC1	
36	PJ9JR	59017	58069	PJ9	
38	PZ1AH	57018	56041	PZ1	
40	PY2CK	56019	55046		
OFF	0500 - 1000 = 5Hrs				
1001	G3NMH	57020	57125	G3	1
03	DL4RM	56021	56205	DL4	
05	DJ6QT	56022	56230	DJ6	
12	DL4CQ	55023	55090		
14	I1BAF	55024	55301	I1	
15	I1FLD	55025	55299		
21	OH2BH	57026	57405	OH2	
33	OH2AM	58027	57391		
46	UA1DZ	58028	58426	UA1	
OFF	1100 - 2100 = 10Hrs				
2102	~~W1WDO~~	~~59029~~	~~59495~~	Dup.	0
05	VP2MK	58030	59026	VP2	3
07	VP2VL	58031	59086		
10	KP4CL	59032	59623	KP4	
12	WA4NMO/KP4	58033	58536		
15	F2YN/WZ	57034	57123		
20	~~W8IMZ~~	~~56035~~	~~55225~~	Dup.	0
23	W8IMZ/VE3	57036	56098	VE3	3
25	W1GVE	59037	59001		3
		TOTAL POINTS THIS SHEET		24	87

CQ Form 1069 eff. Feb. 1968

A sample log sheet already filled out. Official log sheets are avaliable from CQ, see (7.) below.

6. OCEANIA—Single Operator, All Band. A Trophy donated by Jack Chalk, KW6EJ.

XI Club Competition: No club award is planned at this time, however one may be given if sufficient interest is shown.

XII Log Instructions: 1. All times must be in GMT. The 18 hour non-operating periods must be clearly shown.

2. Use a separate sheet for each band.

3. Prefix multipliers should be entered only the FIRST TIME they are contacted.

4. Logs must be checked for duplicate contacts and prefix multipliers. Recopied logs must be in their original form, with corrections clearly indicated.

5. A prefix check list is not only desirable but a *must* for proper contest operation. (It is recommended that you also send it along with your contest log.

6. Each entry must be accompanied by a Summary Sheet listing all scoring information, the category of competition and the contestant's name and mailing address in BLOCK LETTERS.

Also a signed declaration that all contest rules and regulations for amateur radio in the country of the contestant, have been observed.

7. Official log and summary sheets are available from CQ. A large self-addressed envelope with sufficient postage or IRCs must accompany your request.

If official forms are not available you can make your own by following the attached sample, with 40 contacts to the page.

(Daystrom Limited has made an Internanational Log Form which is available to Canadian amateurs. We will supply them with Summary Sheets. Write to: 1480 Dundas Highway East, Cooksville, Ontario.)

XIII Disqualification: Violation of the regulations of amateur radio in the country of the contestant, or unsportsmanlike conduct, or taking credit for incorrect QSO's or Prefixes, or duplicate contacts in excess of 3% of the total made, will be deemed sufficient cause for disqualification.

Actions and decisions of the Committee are official and final.

XIV Deadline: All entries must be postmarked *no later* than May 1, 1971. In rare isolated areas the deadline will be made more flexible.

Logs go to: CQ WPX SSB Contest Committee, 14 Vanderventer Avenue, Port Washington, L.I., N.Y. 11050. ■

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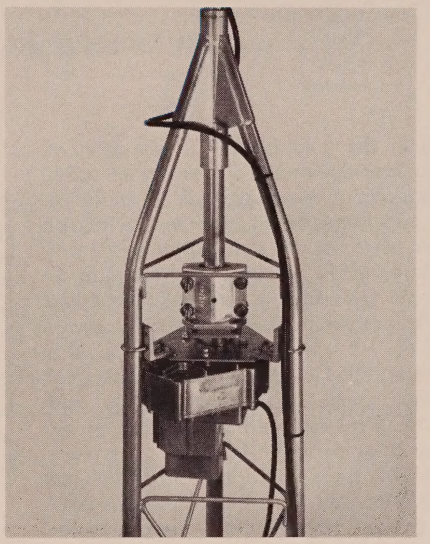

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- Extra heavy duty machined steel gears for maximum strength
- Handsome control unit features sweep pointer over choice of three great circle maps or compass rose
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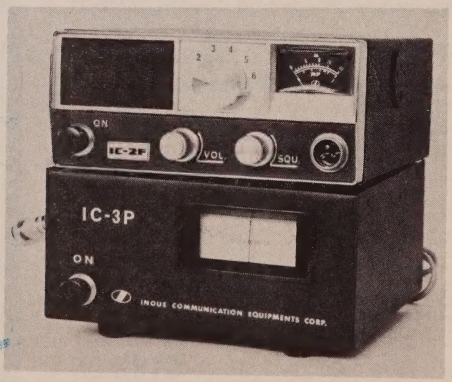
CQ Reviews:
The Varitronics-Inoue IC-2F 2 Meter FM Transceiver

BY GLEN E. ZOOK,* K9STH

ONE of the "old timers" in the field of amateur f.m. equipment is the line of solid-state equipment manufactured by Inoue of Japan, and imported by Varitronics Inc. of Phoenix, Arizona. The latest contribution of Varitronics to the world of amateur f.m. is the IC-2F. This unit is a solid-state crystal controlled transmitter with a minimum power output of 10 watts. The receiver is also crystal controlled, completely solid-state, dual conversion, with excellent sensitivity and selectivity. Provision is made for up to six channel combinations. The unit is factory equipped for operation on 146.34/146.94 mc repeater operation and 146.94 simplex operation. Also, a sturdy mounting bracket, power cable, and microphone are included. An optional power supply (IC-3P) is available for operation from normal 117 v.a.c. lines.

*FM Editor, *CQ*, 818 Brentwood Lane, Richardson, Texas 75080



The Varitronics Inoue IC-2F 2-meter f.m. transceiver sits atop its a.c. power supply unit, the IC-3P which also includes a discriminator meter for tuning and frequency setting. For mobile use, the IC-2F operates directly from a 12 v.d.c. electrical system.

Technical Details

The IC-2F employs complete solid-state circuitry. Special features include provision for external speaker and an accessory power jack. A tuning meter giving relative power output and relative signal strength is provided in the basic transceiver. The power supply for home operation (IC-3P) includes a discriminator meter for tuning and frequency setting operations. The unit is built on epoxy based printed circuit boards of excellent workmanship. The transmitting section is hinged for ease in repair and tuning.

Receiver

The receiver section of the IC-2F employs a dual-conversion superheterodyne design with a high i.f. of 10.7 mc and a low i.f. of 455 kc. Two ceramic filters (one in high i.f. and one in low i.f.) are employed for adjacent channel rejection. Solid-state antenna switching and power switching (receiver muting) are used for maximum efficiency and minimum power drain.

The r.f. amplifier is a JFET for low noise operation. The amplified two meter signal is then applied to the first mixer through five tuned stages. In the first mixer a signal 10.7 mc lower in frequency than the desired signal is injected to provide a 10.7 mc high i.f. signal. This injection is provided by a 45 mc range crystal which is multiplied three times to produce the desired 135 mc injection frequency. Provision is made to "warp" or "rubber" the receiver crystal for on-frequency operation. The 10.7 mc signal is then passed through a filter network consisting of two ceramic filters "back-to-back" to give good selectivity at the 10.7 mc point. The 10.7 mc signal is then applied to the second mixer for conversion to 455 mc. This is accomplished by the injection of a crystal controlled signal 455 kc below the high i.f. frequency.

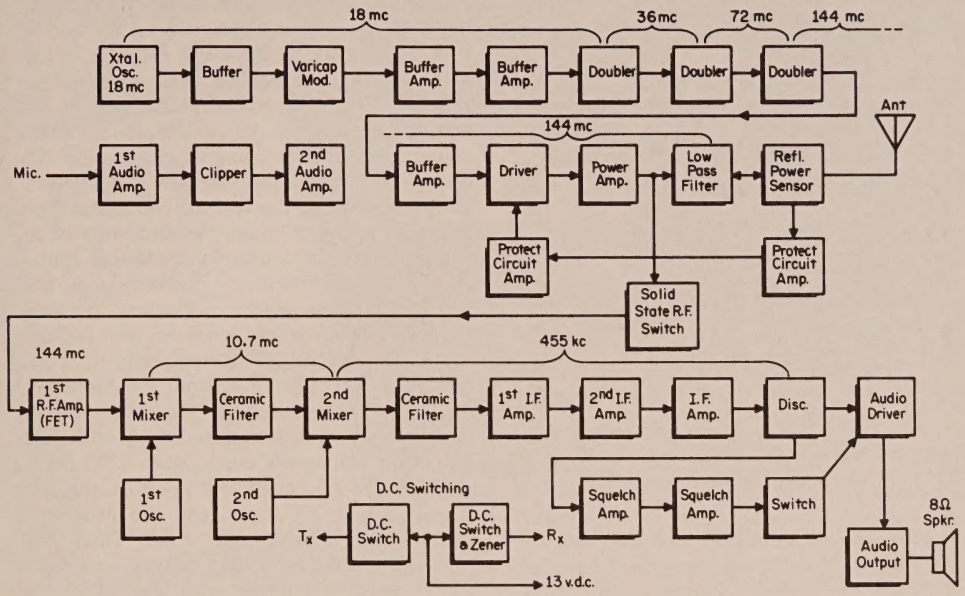
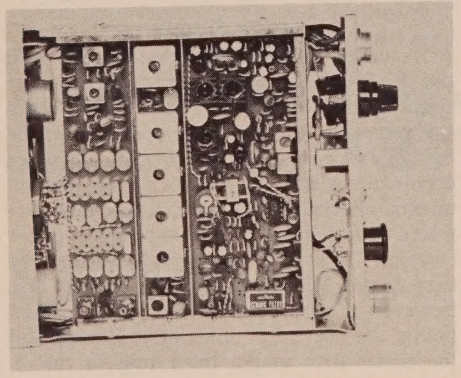


Fig. 1—Block diagram of the Varitronics Inoue IC-2F 2 meter f.m. transceiver.

After conversion to 455 kc the signal passes through a second ceramic filter network. The 455 kc signal is then amplified by a two-transistor-and-one-integrated-circuit network. Audio intelligence is then acquired from the 455 kc signal by a discriminator circuit. This audio is amplified by a single transistor stage and applied to a common emitter output stage, which is directly coupled to either the internal speaker or to an external speaker through a jack on the rear of the unit. Squelch action is the result of the application of a d.c. bias derived from rectified noise. The squelch threshold is adjustable by a potentiometer on the front panel.



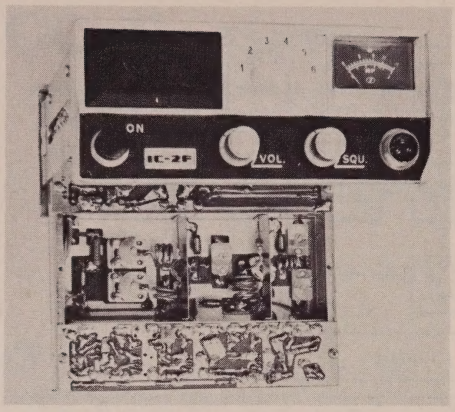
Two tuning diodes (voltage variable capacitor diodes) can be used to electrically replace a bulky air variable capacitor. Advantages are flexible tuning posibilities and more reliable operation. (Photo courtesy Eastron Corp., Haverhill, Mass.)

Transmitter

The transmitting section of the IC-2F is also completely solid-state with six crystal controlled channel capabilities. Ten transistors comprise the r.f. circuitry. Three transistors and a Varicap diode comprise the modulator section. A high s.w. sensing network is provided to reduce the drive to the final amplifier transistor if the reflected power reaches a point at which damage may occur. The operation of the transmitter section is straight-forward and may be easily seen by the block diagram above.

Construction

The construction of the Varitronics-Inoue IC-2F was excellent. The material used in the printed circuit boards appears to be of two different types. Some boards are manufactured from a material similar to the epoxy G-10 board used by many manufacturers in the United States. The remaining boards are of quality phenolic base. Although this material is not as good as the glass based board material, it appears to be of much better



The entire transmitter section of the IC-2F drops drops down for convenient service. Note the use of air trimmers here, too.

quality than the XXXP phenolic material sometimes used. The components used appear to be of very good quality. Air variable capacitors, rather than the usual ceramic trimmer or pressure type capacitors, are used extensively in the r.f. and crystal "warp" circuitry. General workmanship, such as soldering, was good. There were traces of resin flux on the boards, but, for the most part, clean-up and general soldering techniques were good.

Performance

The IC-2F was judged against the published specifications for the unit. During these tests the IC-3P a.c. power supply was used as the power source. The unit performed as follows:

Test	*Published Spec*	*Achieved*
Rcvr Sens 20 db quiet	0.4 μv	0.35 μv
Bandwidth at 6db	15 kc	16 kc
Trans. Power Output	10 w. min.	11 w.
Frequency Deviation	±10 kc (nom.)	±9 kc

Both transmit crystals, 146.340 and 146.940 mc, were within 1 kc for the desired output frequency as set from the factory. The receiver crystal was almost 11 kc low at 146.940 mc. Adjustment of the crystal trimmer moved this up to 7 kc low. Replacement of the crystal was then decided as the only correct cure. Such a defective crystal appears occasionally, but is the exception rather than the rule.

The deviation was a little high for narrowband areas and had to be reduced for operation through the narrowband repeater in use at Ft. Worth, Texas. This was accomplished by the adjustment of the audio gain in the transmitter section. An on-the-air check resulted in favorable coments concerning the quality of transmitted signal. The stations contacted during the test all concurred that the audio sounded "bassy" when compared to the author's usual Motorola equipment. However, this low frequency response was not objectionable to anyone contacted. A comparison with an audio generator and oscilloscope showed the IC-2F beginning to "roll-off" at about 2500 c.p.s. Both the Motorola "K" transmitter used in the base station and the "H" transmitter in the Motrac did not begin rolling off until about 3200 c.p.s. Also, the IC-2F began rolling off on the low side at about 200 c.p.s. and the Motorola equipment at about 300 c.p.s. Thus, the logical explanation for the "bassy" sounding audio when compared with the Motorola equipment. This is not a fair comparison; in fact, had not the operators at the receiving end been familar with the author's voice no comment would have been forthcoming.

The receiver audio was somewhat "tinny". This is due to the small size speaker built-in the IC-2F. Since provision is made for an external speaker a suitable 8 ohm five inch speaker was tried. The audio improved considerably. Varitronics-Inoue recognizes this and provides not only the connector but supplies the plug to mate with the jack along with other miscellaneous hardware.

Power Supply

As stated before all tests were made with the IC-3P a.c. power supply. This power supply operates from 117 v.a.c. and provides the necessary 13.8 v.d.c. for operation of the IC-2F. The power supply unit includes a discriminator meter for alignment and on-frequency checks. The meter is calibrated with a zero-center and +5 and −5 points at either extreme. This gives the impression that the extreme points are + and − 5 kc. This however, is not true. The instruction manual points out that each point of calibration on the meter (five marks from zero to the + and − 5 points) are about 400 c.p.s. each. This means that the extreme points on the meter are about 2 kc from center frequency. Since each meter would have to be indivi-

[*Continued on page 118*]

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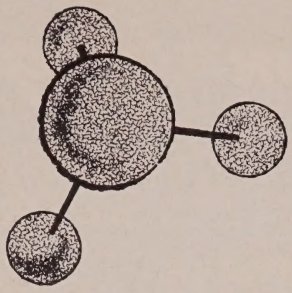

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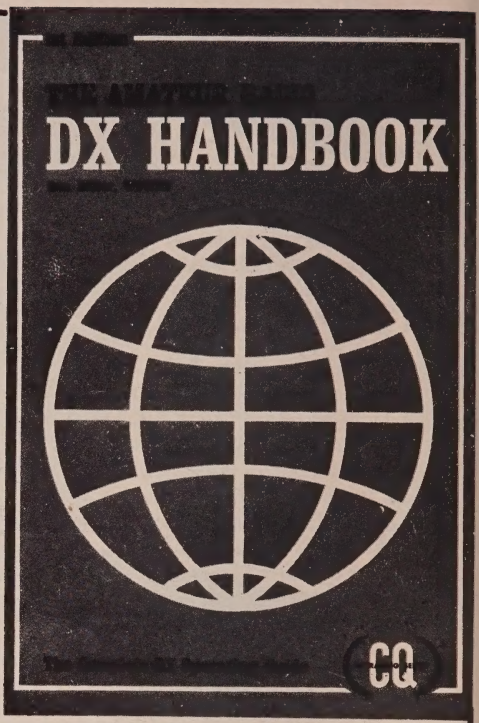

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A Crystal Controlled WWV Converter For The Swan Cygnet

BY JOHN L. CLARK,* W1OE

Most receivers and transceivers may be obtained with a built-in or optional 100 kc crystal calibrator. Ready-made crystal calibrators for use with any receiver may also be obtained at reasonable cost. However, many of the ham-band-only sets have no provision for receiving WWV, the National Bureau of Standards station, and thus no convenient means of checking the calibration of the crystal calibrator itself.

Single Range VFO Receivers

Some receivers and transceivers have a single range v.f.o. and separate crystal-controlled injection oscillators for each frequency range or band to be covered. You can modify some of these sets to receive WWV on 2.5, 5, 10, 15, 20 or 25 mc simply by plugging in a suitable injection oscillator crystal and peaking up the tuned circuits. If you have such a unit, consult the instruction booklet or the manufacturer for details about optional frequency coverage and select the WWV frequency which would be most likely to give you consistent reception from Fort Collins, Colorado at a convenient time of the day. (The National Bureau of Standards also operates WWVH at Puunene, Hawaii which transmits on 5, 10 and 15 mc.)

Receiving 15.0 mc

Other receivers and transceivers such as the Swan sets have a crystal-controlled intermediate frequency oscillator and separate variable frequency oscillator ranges for the various bands of frequencies which the set is designed to cover. In this case, if you want to tune outside these bands you must inject a signal from a fixed or variable oscillator which will beat with the intermediate frequency oscillator in the receiver or transceiver to produce the desired receiving frequency. For example, if you have a receiver or transceiver with a crystal-controlled 5.5 mc intermediate frequency and were to inject a 9.5 mc signal into the mixer stage, you would produce combined frequencies of 15 (9.5+5.5) and 4 (9.5−5.5) mc. If you were to set the bandswitch to the 20 meter range and peak up the tuned circuits with the panel controls, you would then be set up to receive 15 mc. You would also be set up for 4 mc, but wouldn't receive any 4 mc signals because the tuned circuits would be peaked to receive 15 mc. The 15 mc frequency is a good choice for many operators because they can hear Colorado on 20 meters with a high degree of consistency throughout the year. It also has the advantage that 15 mc is somewhat closer to the 20 meter band than 2.5, 5, 10, 20, or 25 mc are to any of the other ham bands and it is therefore more likely to be accepted by the tuned circuits in your receiver or transceiver.

Receiving 15.0 mc with a Swan Transceiver

To take a specific (and tried) example, consider the Swan Model 270 Cygnet transceiver which has a crystal-controlled 5.5 mc intermediate frequency. There are at least two fairly simple approaches to the problem.

1. Use an external variable frequency oscillator which will produce a 9.5 mc output.

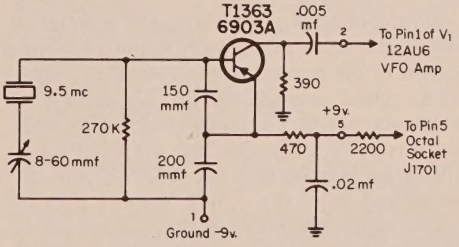

Fig. 1—Circuit of a simple 9.5 mc crystal oscillator for use with the Swan 270 Cygnet transceiver to enable reception of WWV on 15 mc. The circuit is that used in the International Crystal Model OT-3 printed circuit oscillator.

*R.D. 3, Rockledge Road, West Redding, Conn. 06896

2. Use a 9.5 mc crystal oscillator with a zero-adjust trimmer capacitor.

If you happen to have a Swan Model 508 Frequency Control unit, you can use it to receive WWV on 15 mc by switching the transceiver to 20 meters and the frequency control unit to 80 meters. Tune the frequency control unit to 4.0 mc and peak up the transceiver controls. This seemingly perverse approach works because the injection frequency for both 4.0 mc and 15.0 mc reception is 9.5 mc.

If your sole intent is to receive WWV, there are much cheaper ways of doing it including a home brew v.f.o. or a 9.5 mc crystal oscillator. The balance of this article describes the specifications, installation and adjustment of a commercially built crystal oscillator. Component values are shown in fig. 1 for the benefit of those who would rather roll their own.

The Crystal Oscillator

The assembly used is an International Crystal Model OT-3 transceiver oscillator with a matching type CS 9.5 mc crystal. The complete assembly may be purchased from International Crystal Manufacturing Co., Inc., 10 North Lee St., Oklahoma City, Okla. 73102 for $11.10 including postage ($6.00 for the oscillator + $5.10 for the crystal). If you buy the complete assembly, the manufacturer guarantees ± 0.0025% calibration tolerance. The unit is supplied with a zero-adjust trimmer capacitor which enables you to compensate for the combined errors of the 5.5 mc crystal in the transceiver and the 9.5 mc crystal in the OT-3 oscillator. Power requirements are 9 volts at approximately 5 milliamperes.

Installation

Before installing the oscillator assembly, solder wire leads to points 1, 2 and 5 on the bottom of the printed circuit board. Be careful to avoid overheating. If this approach makes you nervous, you can get a socket. The board is designed to fit either a Cinch Type 250 or an Amphenol Type 143 six contact connector.

The entire assembly will fit on top of the v.f.o. compartment in the swan 270 without interfering with either the dial or the top cover. After you've replaced the top cover you'll still be able to adjust the trimmer capacitor by inserting a small screwdriver through the perforation on the top cover.

Mount the assembly by using a spacer and a 1/2 inch sheet metal screw passed through the mounting hole of the oscillator board into one of the holes originally used to secure the v.f.o. compartment cover. If a metal spacer is used, you will automatically make the ground return and −9 volt connections; but the use of the aforementioned wire lead between point 1 and a soldering lug attached to one of the v.f.o. cover plate screws will provide a more reliable ground connection.

Run a lead from point 2 on the oscillator board down through a hole adjacent to V_1, the 12AU6 v.f.o. amplifier stage and solder the lead to pin 1 of the 12AU6 socket.

The +9 volt supply comes in at point 5 on the circuit board. One possibility is to connect a 9 volt transistor radio battery with a single throw switch in series between point 5 and ground. If you don't want to bother with a battery, connect point 5 to the +12 volt supply in the transceiver through a 2200 ohm, 1/2 watt dropping resistor. You can pick up +12 volts at pin 6 on the octal VOX socket (J_{1701}) on the left side of the case. You may use a single pole single throw switch to break the +9 volt connection. Another cheap and dirty solution which gets around the problem of mounting the switch without drilling holes in the cabinet is to connect the +9 volt lead running from point 5 through the 2200 ohm resistor to the empty pin 5 on the octal socket. Put a jumper across pins 5 and 6 of an octal plug or an old octal tube base and you'll have a switch which is quite adequate for the infrequent occasions when you'll want to hear WWV (as long as you don't lose the jumper plug).

Preliminary Check

To check out the unit, insert the crystal into the crystal socket, apply +9 volts to the oscillator and tune the transceiver to 28.5 mc (3 × 9.5 mc). If you hear a strong signal on or near 28.5 mc cut the +9 volts or pull the 9.5 mc crystal out of its socket. If the signal cuts out, you can reasonably assume that your oscillator is working.

Tuning in WWV

The next step is to set the 270 transceiver on the 20 meter range with the antenna connected. Remove the 9-pin plug from the external oscillator socket (J_{1706}) on the back of the set. This will disconnect the internal v.f.o. from the v.f.o. amplifier stage, V_1 and give

[*Continued on page 122*]

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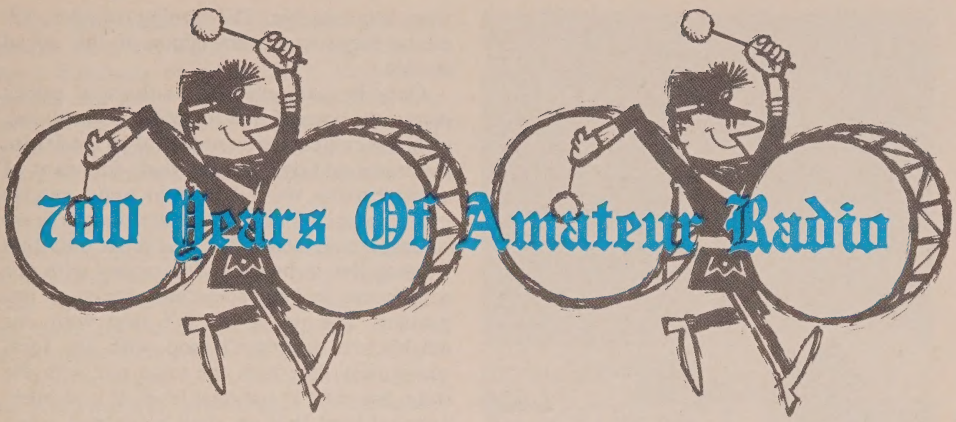


BY SYLVIA MARGOLIS*

I'VE never been the same since David Frost kissed me.

One of the best of our British exports, David Frost. Still in his early 20's, he exploded on a somnolent late-night Saturday TV audience as link-man for a new, satirical program, *That Was The Week That Was.* Now, past 30, David Frost is one of the world's highest-paid interviewers, commuting across the Atlantic each week, to keep programs going simultaneously in London and New York.

British television was never the same once Frost had touched it and I was never the same once Frost kissed me. He kissed me because he was delighted with what I'd written about him in a glossy magazine. The article analyzed the technique of the TV interviewer, starting with Ed Murrow, examined the interviewer's impact on public opinion and questioned his entitlement to achieve that impact.

I'd asked David about the ethics of the interviewer who harrasses his victim, so that the blood spurts into the viewers' eyes, and he replied with the fable of the contest the sun and the wind had to get a man to take off his coat. The wind huffed and puffed and the man only pulled the coat closer round him. Then the sun shone, gentle and warm, and soon the man took off his coat.

The soft sell. It works every time and it works with public relations, even amateur radio public relations, which are as hard to promote as any detergent, politican or dog-food that Madison Avenue ever had to put over.

Amateur radio needs such a lot of public relating. Its worst enemy is its enthusiasts. The image is not fragrant. There's too much TVI, too much trouble with antenna towers and zoning regulations. There's too much popular idea of the radio amateur as the kink, the kook, the social drop-out up to his untrimmed beard in cobwebby junk in a dusty shack. There's too much editorial blather published and absorbed subliminally by readers about 'hams' who are supposed to interfere with aircraft, shipping, police, fire

The author with David Frost.

*95 Collinwood Gardens, Clayhall, Ilford Essex, England.

GB3SUA, housed in a chicken-farm showroom trailer. The author explains to the Law how it all works!

and ambulance communications; with the weather, the corn crop and national security.

In Britain things are more difficult even than in the U.S., because British licensing regulations forbid the use of phone patch and 3rd party traffic, under any circumstances. So British amateurs can't render that ultimate *service* to the public that American amateurs can offer—to handle Servicemen's personal traffic. For an amateur to be able to offer this facility to his neighbours, image-

Born at Stratford only 400 years ago.

wise, is invaluable. TVI, zoning troubles, will all be forgotten in the glory of this social service.

Only by example, by on-the-spot public demonstrations of that scientific, educational, public-service, international friendship, sweetness-and-light hobby that, for want of a better name, we call *amateur radio,* can we project and cherish and nurture the image we so desperately need. We need it not only that we may live in peace and harmony with our neighbours, but for something far more important. The image doesn't stop with our neighbours. It doesn't stop with the local community, nor with the town nor with the state, not even at national level. It is at international level that we shall be judged, when it comes to the next frequency allocation conference, by which amateur radio might very well stand or fall. And from international level it relates right back to G3XYZ and W2XYZ and their TVI and what they are doing about it!

As past P. R. Officer of the Radio Society of Great Britain it was one of my functions to seek out and promote opportunities for such demonstrations. I've had some success—see *By Permission of Her Majesty Queen Elizabeth II* and *Two Weeks in a Goldfish Bowl.*[1] But, spectacular as these projects were, there was always criticism among R.S.G.B.'s members that they were London-based, conceived, gestated and delivered by R.S.G.B. Headquarters. U.S. readers will understand, for there's the same attitude among A.R.R.L. members, far from Newington, towards any Newington-based ideas..."It's all very well for you at Headquarters. You've got the talent, contacts, influence, money. What about us here in Spalding... or Spokane, Kidderminster or Kalamazoo, Mexborough or Memphis? You can't expect us to mount big, ambitious public relations promotions."

Yet it's at the grass-roots that the thing must start. A citizen might read in his national newspaper about an amateur who saved a life the other side of the continent—and he'll forget about it within the hour. But let him talk to his son in Viet Nam or let him see an efficient demonstration of amateur radio, just around the corner, and he'll be impressed and remember what he's seen.

[1]Margolis, S. "By Permission of Her Majesty Queen Elizabeth II," *CQ,* Aug. 1968 p. 32.

Margolis, S. "Two Weeks in a Goldfish Bowl," *CQ,* Feb. p. 36, Mar. p. 27, 1969.

And grass-roots efforts at public relations usually carry more impact than projects devised hundreds of miles away. Only local people can know local standards and conditions. Only local people have the necessary 'pull' with local officials. And this pull can move mountains, as it did at Stratford-upon-Avon, in 1969.

There are a few local R.S.G.B. groups and clubs who handle their own public relations with enterprise and verve. I help them all I can. And from them, sometimes, I learn a lot about the public relations game, as I did at Stratford-upon-Avon, in 1969.

Stratford-upon-Avon, in the lovely county of Warwickshire, pronounced *Worrickshire*, is just to the left of the middle of England, as you look at the map. The town is renowned as the birthplace of one merchant's son, who left it in a hurry after a disagreement over the ownership of some deer, joined a company of travelling actors and achieved some fame as a playwright—one William Shakespeare.

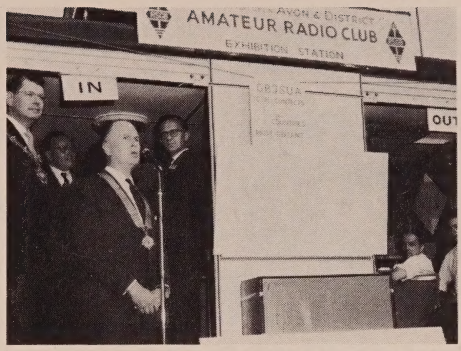
There's another Stratford in England, an unprepossessing area of London's East End, whose only claim to fame is that Fox's *Book of Martyrs* tells of two religious martyrs who were barbecued in its market place in the 17th century. There are Stratfords in Ontario, Connecticut and Australia.

Stratford-upon-Avon is a picturesque town, exploiting to the nth degree its local boy who made good. Every citizen of the town is a practised public relations promoter. The Royal Shakespeare Theater, one of the ugliest civic buildings in the world in one of the most beautiful settings, is one of the world's major theaters. Millions of tourists flock to Stratford each year.

To the public relations practitioner the obvious angle of Stratford and amateur radio is as simple to link as bagels and lox. The Bard wrote of *putting a girdle around the earth in 40 minutes*, which would have been before the days of sideband. And it's easy to unbutton your imagination and let rip with gems like *doublet fed with hose* or the UB5 *who bestrides the frequency like a colossus or* even *bubble, bubble toil and trouble, don't break in or there'll be trouble.* I can see it all, in wonderful technicolor, vistavision...

This, though, wasn't at all what Stratford had in mind in 1969.

William Shakespeare was born in 1564, which is only four centuries ago, no time at all in Stratford's reckoning. Three hundred years before that, local government began in



GB3SUA opened by an inadvertently halo-ed R.S.G.B. President, G2YS, John Swinnerton.

the town. The year 1969 was to see the 700th anniversary of that anniversary, which relegated Shakespeare to the Little League in the antiquity game.

Stratford-upon-Avon & District Amateur Radio Club were invited by the Town Council to help celebrate the anniversary by operating an exhibition amateur radio station, with the callsign, GB3SUA.

On their own initiative, this small club had negotiated an exhibition site with the Council, on the lawns right across the river from the Royal Shakespeare Theater. They had persuaded a local firm, who owned a big showroom trailer, to lend them the trailer to house the station. They had arranged the erection of antennas, located power supplies and most of the equipment, even got a small financial grant from the town to cover expenses. They had notified the local Press and made contact with local radio and TV stations, to get advance publicity, as well as fast-closing coverage of the event.

R.S.G.B. President presents the Mayor of Stratford with a souvenir of GB3SUA.

Casual visitor W9WNF, Timothy Kearney, from Fort Wayne, Indiana. The author's son, G3UML, Laurie, is operating.

They asked for my advice and help!

"Have pretty operators!" I suggested.

What else could I add? They had done it all. The pretty-operator bit is my own gimmick for these big publicity events. If I promote an exhibition station, the operators must be clean, presentable, well dressed, well spoken and very, very articulate, as well as being slick radio operators. Keep the kinks and the kooks, no matter how technically-brilliant they might be, for internal amateur affairs, where their undoubted talents will be appreciated. But show the public, who hold us in such suspicion at our best, that at least your radio amateur is an alright-Joe, as normal as the next Joe and just as reliable and reasonable a citizen.

The only other contribution I could make from London was to arrange U.S. publicity and a couple of skeds, to negotiate the loan of some of the equipment and the p.a. talk-through we had used at GB2LO with such success and to provide one Official Opener and two tough, very experienced DX-operators. Then I asked if we could come along to join in the fun. For it sounded like fun.

The Mayor of Stratford's official car, with Stratford Parish Church in the background.

"I have a very well-bred travel trailer that would look just fine alongside the amateur station. And if we are there it means there will be somebody on hand all night to guard the goodies."

Stratford thought we were doing them a favor. What I didn't tell them (after all, public relations is *my* business!) was that this was the first chance for a year my elder son, Laurie, G3UML, had had to operate again with a rare prefix. The last time had been with GB2LO, the historic City of London Festival station, where he had been, he said, such sought-after DX that he felt like Don Miller, only loved.

The other tough, experienced DX-operator was my Ever Loving Husband, Maurice, G3NMR. Often I am asked which of us is the more enthusiastic about amateur radio. I'm not entirely certain. Whilst I was in the United States, to attend the 1969 A.R.R.L. Naional Convention at Des Moines, I had left him to make the final arrangements with Stratford, because I wasn't due back in U.K. until a week before the event. He says he doesn't really enjoy these jobs, but I make him see things my way. Marshall Dillon never has such trouble finding willing deputies when he leaves town. Sometimes I wonder if my husband's heart is really in amateur radio, whether he's got his priorities right. When he first took up the hobby and kept telling me the usual tale about how lucky I was that my husband spent his spare time with radio, not with blondes, I believed him. Sometimes I think now that gentlemen would have preferred blondes.

There were to be other celebrations in Stratford that weekend, an old-fashioned steam fair, dancing in the streets, a pig-roasting, fireworks, a river carnival, a vintage Rolls Royce parade, all the traditional hoo-ha of the Englishman at play.

Stratford-upon-Avon, as we arrived on the Friday evening of the GB3SUA weekend, looked like a put-up job. The flags were out, the traffic already thick, the crowds gathering for the roistering. The weather was glorious, which added to the zest, because most British occasions are accompanied by pouring rain or worse. Something happens to the British when the sun comes out and there was madness in the air that night.

We parked the trailer and looked round. To quote the cockney vernacular, it was a bit of alright. Manicured lawns swept down to the River Avon, sparkling in the slanting

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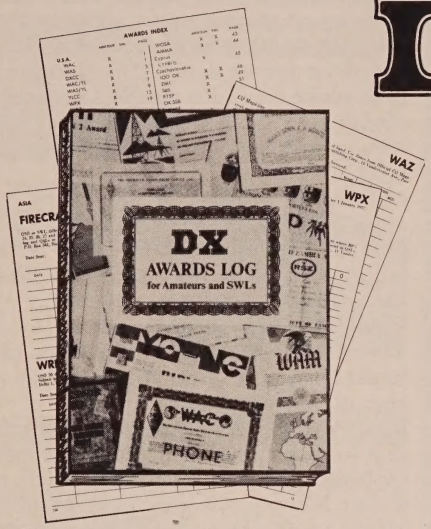
DX AWARDS LOG



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Never mind, Hamlet, there's always 20 meters!

evening sun. Stage-prop, detergent-white swans glided on the still waters. Across the river the lawns sloped up to the Royal Shakespeare Theater, mercifully silhouetted (so you couldn't see it very well) against a turquoise sky and a sunset that was, to say the least, un-British in its gaudy over-statement.

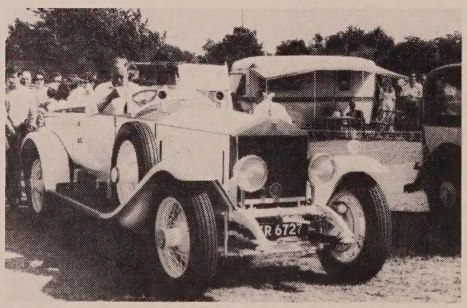
To our left the spire of Stratford's ancient Parish Church. On our right the brilliantly-lit trailer containing GB3SUA. The air was very warm and scented with grass and river dampness. A cardboard scenery moon rose over the trees.

The theater audience came out in the interval and stared at us from the balconies. We stared back. We were in the same business. Shakespeare was the greatest of communicators. Our business in Stratford was communication.

And very nice, too. The borrowed trailer looked nothing at all like the chicken-farm showroom that it was. (The name of the owners was Wigfield & Pluck and that's true, so help me!) It was very swank and the outside was decorated with troughs of flowers, courtesy of the Stratford Parks Committee. All modern conveniences were close at hand. The proximity of the public toilets was welcome, not for their obvious assets, but because it was from the lavatory building we took the electric power for the station. This situation gave rise to some confusion abroad. Our operators' casual:

"The power here comes from the ladies' toilet..."

had 'em all guessing, if not rolling in the aisles, not least in technological circles behind the Iron Curtain, where they wouldn't put anything past the cunning of Western Imperialists.



There was a vintage Rolls Royce Rally...that's the author's trailer in the background. Sorry, there's no price tag we can attach to this particular car. The owner found it derelict in a pig sty and has spent over $10,000 refurbishing it.

GB3SUA was formally opened by John Swinnerton, G2YS, 1969 President of the Radio Society of Great Britain, in the presence of the quite enchanted Mayor of Stratford. Afterwards we entertained His Worship to sherry under our trailer awning and explained all the wonders of amateur radio to His Worship. There's no proof that the Mayor would start practising Morse that very night and it's more than likely that his interest stemmed more from his aching feet than from his urge to communicate. He'd been Opening things all day and it must have been a relief to sit down for a few minutes in the cool of evening and sip R.S.G.B. sherry, even if it did mean listening to radio amateurs talking jargon.

The stations operated almost continually for 48 hours, logging more than 1,000 contacts, with 72 countries, including what is for Britain some very DX-Cayman Islands, Thailand, Hawaii, a 4X4 who quoted Shakespeare at us, a gaggle of JA's, all of whom seemed to have visited and photographed Stratford-upon-Avon, and lots of other Pacific and West Coast W's.

There was a Mosley beam, high, and a KW trapped dipole. There were 3 stations; a KW-2000A on the h.f. bands, s.s.b.; a KW-2000A on 80 m s.s.b.; a DX-100 and Eddystone EA-12 on 80 m a.m.

The crowds began to gather round the stations early in the mornings; beautiful English Summer country mornings they were, that Saturday and Sunday, precious because they are so rare, scented and misty and blue-and-gold and the green you get only in England.

First customers were the dog-walkers.

[Continued on page 117]

DRAKE ...everything for the Ham

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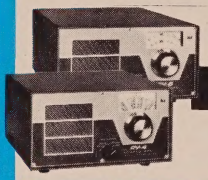
RECEIVERS: Sensitivity for 10 dB S/N: **TR-4** .5 μV, **TR-6** .1 μV (FET front end) **Selectivity: Both** 2.1 kHz @ 6 dB, **TR-4** 3.6 kHz @ 60 dB. **BOTH** have diode & prod detectors, S-meter.



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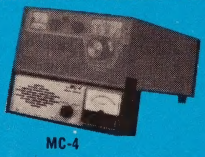

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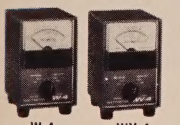

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Fwd and refl pwr directly in watts • Two scales each direction • Calib Acc: ±(5% of reading + 1% of full scale)

Model	Range	Full Scale	Price
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5"x7" speaker, space for power supply **$22.00**

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60-8000 Hz, ceramic, Hi-Z, highly directional, plug . . .
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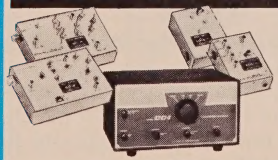

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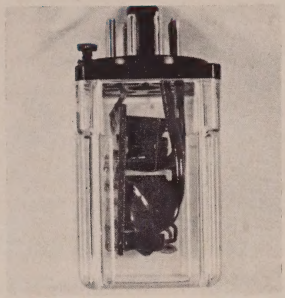
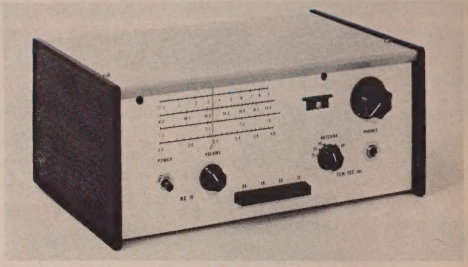


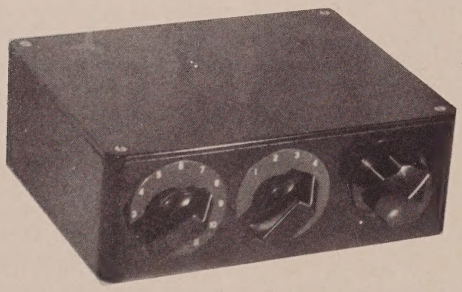
Harrison Enterprises

HARRISON Enterprises is now marketing a c.w. adapter for the Heath HW-12A, 22A and 32A s.s.b. transceivers to extend its normal operation. The tone oscillator inserts into the socket provided for a crystal calibrator and only minor circuit changes are necessary. The c.w. modification kit sells for $14.95. Crystals and socket to extend the frequency coverage are available for $4.95. For more information write to Harrison Enterprise, P.O. Box 201, Bound Brook, N.J. 08805, or circle 80 on the Reader Service coupon.



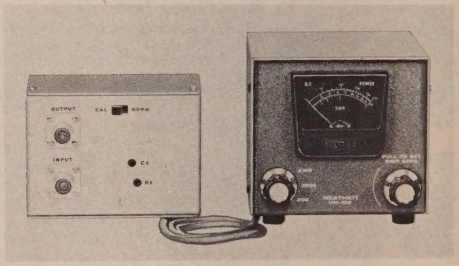
Ten-Tec RX10 Receiver

TEN-TEC announces the new RX10 communications receiver covering 80, 40, 20, and 15 meters. A synchrodyne circuit of single conversion eliminates images and birdies usually found in low-priced receivers. Drift is less than 100 c.p.s. and selectivity is 2 mc at 6 db down. Sensitivity is rated at less than 1 uv for readable signal. It has a built in oscillator that can be used for code practice or for a side-tone monitor. Designed primarily for beginners, it is priced at $59.95. For complete details contact Ten-Tec, Highway 411, East Seviervill, Tennessee 37862 or circle 81 on Reader Service coupon.



Top Band Systems 160 Meter Matchverter

TOP Band Systems announces the development of the Model 48MV 160 meter matchverter which will resonate practically any 40 or 80 meter inverted vee/dipole antenna on 160 meters. The Model 48MV will handle output powers of 140 watts on c.w. and a.m. and 250 watts p.e.p. on s.s.b. For detailed information write to Top Band Systems, 5349 Abbeyfield St., Dept. 1, Long Beach, California 90815 or circle 79 on Reader Service Coupon.



Heath HM-102 Wattmeter/s.w.r. Bridge

THE new HM-102 measures RF power output from 10-200 and 100-2000 watts throughout the 80-10 meter amateur bands with 10% accuracy. Built-in s.w.r. measurement capability allows proper transmitter tuning, transmission line-to-antenna impedance matching. The exclusive Heath remote detector permits placement of the meter in any convenient location. The kit sells for $29.95. For additional information on the new Heathkit Wattmeter, contact Heath Company, Benton Harbor, Michigan 49022, or circle 84 on Reader Service coupon.

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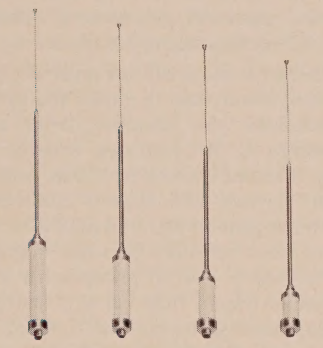

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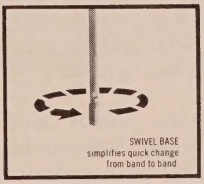

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PARALLEL FED VERTICAL COLLINEAR FOR 2 METERS

BY SHERMAN C. CARR,* W9NGT

A flexible design of simple construction to provide omnidirectional gains of from 6-13 db as required.

MANY v.h.f. traffic nets, AREC groups, mobile operators and many others, have pretty much settled on vertical polarized antennas on 2 meters, for obvious reasons. Some operators utilize both horizontal and vertical polarization, switching from one to the other as the need arises.

Upon getting into v.h.f. work, if the choice is vertical, almost everyone puts up a simple ground plane to get started. The serious operator, however, soon finds this simplest of antennas has severe limitations, even after he gets his receivers down to two or three tenths of a microvolt, and soon begins to look around for something more effective. He may go various routes in pursuit of antenna gain, depending upon his patience, knowledge of antenna fundamentals, and his pocketbook.

Investigating the various "gain" antennas in a typical program disclosed that most configurations exhibited some strange behavior; most gave more or less indifferent performance. Some were difficult to tune, some presented serious matching problems, some were physically difficult to construct, and so on.

It was felt that one requirement of the 2-meter array must be that it be at least essentially omni-directional, which almost dictates some sort of collinear system. But all series fed collinears, whether excited at the center or bottom, suffer from transmission line effects, they are difficult to tune, and the gain per dipole added does not come out per the arithmetic at all. From the literature, and from experiments with the various collinears it appeared that the dipole end to end spacing should be optimized for maximum capture area, they should be fed in parallel to eliminate transmission line effects. Meeting these requirements automatically took care of two more; ease of tuning, and ease of matching to the line.

*756 W. Washington Ave., Hartford, WI 53027.

The Four Ground Plane Array

Researching the various publications for ideas disclosed an array of four drooping ground planes mounted to an aluminum mast, which showed much promise. As described, it required over thirty dollars worth of coax fittings, a complex matching harness, and the radiation angle looked to be no better than that of a single ground plane alone, but the idea of feeding four elements in phase, in parallel, still seemed to look the best of any configuration yet tried.

Just a bit more on this ground plane array. It was stated that to make the system non-directional, the ground planes should be mounted at 90° intervals around the mast. This aroused some suspicions, and checking with Terman and Brown confirmed them. With the ground plane to mast spacing shown there must certainly be some degradation of performance due to phase error introduced by wave transit time, in turn caused by the signal passing the nearest element, and then passing two more ground planes almost a quarter wave further. The fourth dipole, swept last, probably contributed little to the situation, either good or bad, being shaded from the signal by the mast.

Signals arriving from different azimuth points are probably subject to various phase errors, which means that the field may not be omni-directional, but rather a cloverleaf pattern with some fairly deep nulls of up to 6 db or so. With all elements in line on one side, the array becames a two element beam

with collinear driven elements, and the front to back ratio is less than 3 db, and the pattern is truly circular but with the antenna about 2.8 db off center, a much better arrangement.

Stacked Vertical Dipoles

Still looking at the four ground plane setup, it occurred immediately that the matching harness could be simplified, the expensive coax fittings eliminated by careful splicing, and straight dipoles instead of ground planes would not only be easier to fabricate, but would certainly display a much lower radiation angle.

Skipping the development stages, what evolved is a highly satisfactory v.h.f. antenna system of proven performance. It is easily constructed from readily available materials, and if desired, can be constructed by formula and operated *without tuning*. The two element version shows a good, honest 6.5 db gain, and the four element model adds another 3 db or so. It can be made very rugged, and shows no appreciable s.w.r. increase when iced up. The matching harness is very simple, and the system has excellent broad band characteristics with dipole elements of 5/8" diameter or larger.

Description

The 2-meter vertical array consists of two or more center fed dipoles connected in parallel to radiate in phase by a suitable harness, and mounted in line on an aluminum mast. The dipoles are spaced 0.22 wavelength from the mast to bring the dipole impedance to 50 ohms, and are spaced 0.9 wavelength apart, center to center, to minimize mutual impedance coupling, and to provide optimum capture or aperture illuminated by each diole. Its radiation pattern can best be described as essentially circular, but with the antenna 2.8 db off center. Its vertical radiation angle is quite low, evidenced by the fact that, with the system radiating 30 watts, a quarter wave ground plane at the top of the support mast puts virtually no signal into a receiver only 1.74 mc away.

The two dipole version requires a mast 12 feet long; and four dipole version requires a mast 24 feet long. If the array is mounted on a non-metallic support it can be shortened to just enough to extend beyond the top and bottom dipoles by 2 inches. Although no attempt has been made to carry physical and electrical parameters to the point of diminishing return, it appears that dipole element diameter of less than 1/2" will begin to show a reduction in bandwidth, and a diameter beyond 1½" shows no further improvement in bandwidth. The mast diameter was kept at 2" mainly for physical strength.

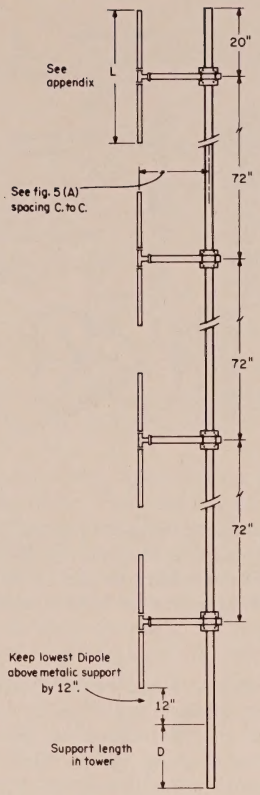

Fig. 1—General configuration of a four-dipole stacked vertical array.

The dipole elements and the dipole support arm are assembled by means of Nylon or Delrin plastic plumbing Tees, available at Sears and almost every hardware or plumbing outlet. They are available in fractional pipe sizes from 1/2 to 1½", and aluminum tubing is available to press fit the o.d. of these Tees. They are very strong, and maintain good dielectric properties over long periods of time. The support arm is mounted to the mast with an aluminum plate drilled for U bolts; two for the arm, two for the mast. These are also available from much the same sources as the Tees. The blocks are made from ⅛" to ¼" thick aluminum plate.

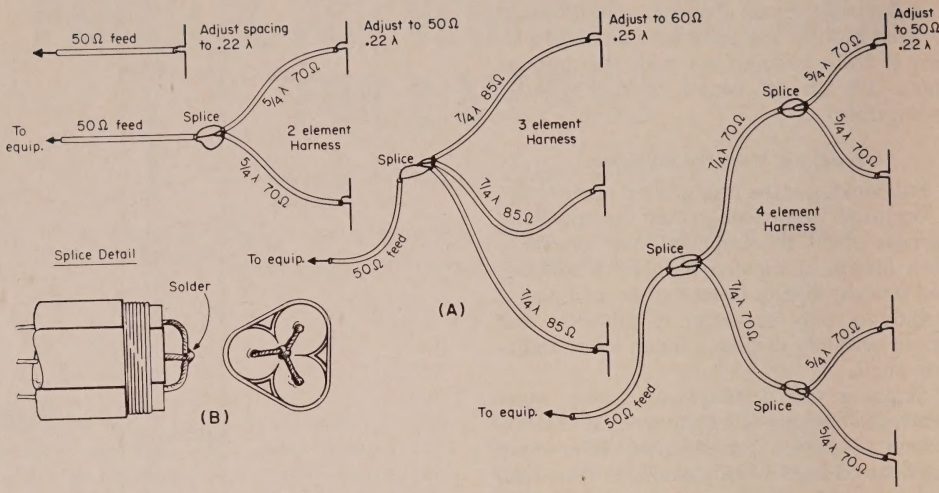

Fig. 2—(A) Dipole harnessing arrangements for 2, 3 and 4 dipole arrays. For six dipoles duplicate the 3-element harness and connect each to 50 Ω line through an odd 1/4 λ length of 70 Ω line. (B) Splice detail. Wrap 1/4" exposed ends of coax braid with bare wire and solder. Also solder junction of coax braids at center of splice before soldering center conductors.

Dipole elements and support arms can be made from almost any type of aluminum tubing, but the mast should be good quality aircraft frame tubing, Alcoa 6061-T6 grade or equivalent. It is heat treated and rubbery, but very, very strong. The steel U bolts and nuts must be tinned in salt water areas, but cadmium or zinc plating will do elsewhere. If all hardware and fittings are sprayed with a number of coats of Krylon or equivalent practically no deterioration will occur due to weather.

Electrical Development

Beam antenna theory states that when a driven dipole is spaced a quarter wave from a reflector its characteristic impedance of 70 ohms is essentially maintained. Moving the dipole closer to the reflector lowers the impedance, and when spacing approaches 0.1 wavelength, the Q goes up, and bandwidth is reduced. When dipole-to-reflector spacing is approximately 0.22 wavelength, dipole radiation resistance is about 50 ohms. Feeding two dipoles in parallel from a 50 ohm line means that each dipole impedance must be raised to 100 ohms so that the two in parallel will present a load of 50 ohms. This is done simply by inserting an *odd* number of quarter waves of 70 ohm line between each dipole and the 50 ohm feed line. It makes little difference (except for line losses) how long this matching section is, as long as it contains an *odd* number of quarter waves.

To feed four dipoles, two pairs of dipoles are set up as above, and then *each pair* is fed by another matching section consisting of an odd number of quarter waves of 70 ohm line. The 50 ohms obtained by paralleling the 100 ohm inputs to each dipole matching section is again transformed to 100 ohms, and these two additional matching sections are paralleled to show 50 ohms, and will then match the 50 ohm feed line.

If the builder insists on using a 70 ohm feed line to save that 0.2 d.b. loss per hundred feet, all matching sections are made from 93 ohm coax, and dipole-to-mast spacing is adjusted to a dipole radiation resistance of approximately 60 ohms.

All this is based on the fundamental relation of impedance transformation for r.f. transmission lines and is $Z_0 = \sqrt{Z_1 \times Z_2}$ where Z_0 is the characteristic impedance of the matching section, Z_1 is input impedance, and Z_2 the load impedance. All this is well delineated in the handbooks, so it will not be dealt with further here. However, with the variety of coax impedances available, it is apparent that any reasonable number of dipoles could be matched to 50 or 70 ohm feed lines by juggling the dipole to mast spacing,

(as long as it does not go much below .15 wavelength) matching section impedances, etc. It must be kept in mind that matching sections must be cut according to the velocity factor, and dipoles and matching section dimensions should be for the center frequency of the antenna coverage desired.

Matching three dipoles to a 50 ohm line can be accomplished by using 93 ohm line for the matching sections, and adjusting the mast-to-dipole spacing to show a dipole impedance of about 57 ohms. In this case, the input ends of *all three* sections are paralleled and connected to the 50 ohm line. In all cases, final adjustment consists of changing the dipole to mast spacing in small increments, keeping all dipoles equal, to obtain the lowest s.w.r.

One other important detail is the necessity of feeding the coax *through* the support arm to connect to the dipole elements. The support arm is cut slightly long, and functions as a capacitively coupled line balancing bazooka. A hole just large enough for a snug fit to the coax is drilled in the plastic Tee, centered on the axis of the support arm, and the coax is spread at this hole, with the coax braid feeding the *upper* dipole element and the center conductor feeding the *lower*. This is important for lightning protection.

Mention should be made about the 0.9 wave spacing on the mast. Optimizing this almost eliminates mutual end to end coupling between dipoles, the capture area for receiving is $2N-1$ where N is the number of dipoles in the system; for transmitting, the radiation angle is very low, and the wave front maintains its polarity somewhat better over rough terrain. In short, the benefits accrued approach those of an antenna with twice the elements.

Construction

Although construction of any version of this system is relatively straight forward and easy, it must be stressed that results will be about in proportion to the care and quality of workmanship. Especially important are the matching section spices and connections to the dipoles. If not done carefully, the discontinuities caused by sloppy spices will most certainly cause a high s.w.r. But if everything is done properly, the s.w.r. will come right down to 1.3 to 1 or lower.

A tubing cutter should be used, (not a hack saw), for dipole pruning, and all burrs and sharp corners must be removed, and the corners nicely rounded. Splicing and terminations are key items. Coax feeding the dipoles must be stripped carefully, the outer braid carefully combed and inserted in a tinned copper terminal, and connected to the upper dipole element with thread cutting cadmium-plated screws and internal-tooth shakeproof washers. The inner conductor the same. After terminations are made, the leads dressed straight, flat, and neat, the braid and inner conductor are soldered in the terminal ferrules using a minimum of solder. All resin flux is removed with acetone or scraping, the whole Tee washed with solvent and then sprayed with a number of coats of Krylon or equivalent.

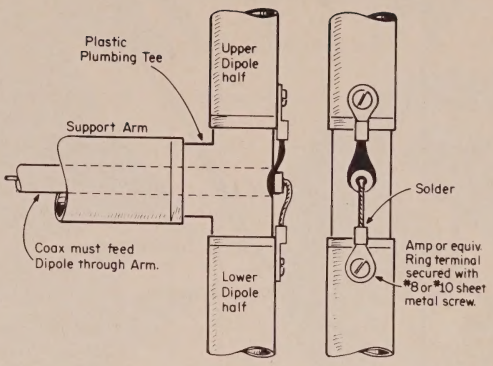
Plastic Plumbing Tee
Upper Dipole half
Support Arm
Coax must feed Dipole through Arm.
Lower Dipole half
Solder
Amp or equiv. Ring terminal secured with #8 or #10 sheet metal screw.

Fig. 3 — Construction details of dipole center insulator and connections.

Matching section splices are even more important. Enough outer jacket is stripped to allow 1/4" of exposed outer braid, 3/16" of the dielectric, and 3/8" of inner conductor. Sections to be spliced are bundled together

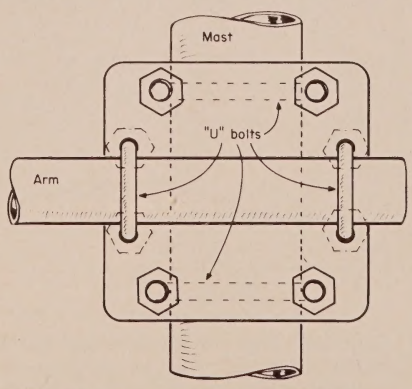

Fig. 4—Dipole mounting plate detail. The plate is constructed of 1/4" aluminum plate. U-bolts should be chosen to fit tubing sizes used.

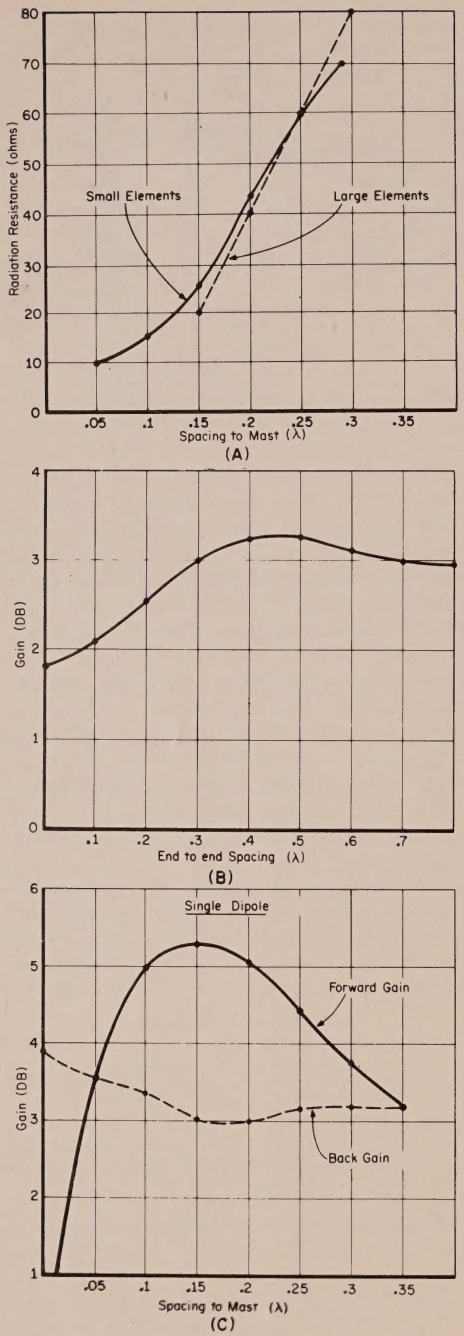

Fig. 5—Design curves for the vertically stacked 2 m. dipole array. (A) Center-to-center spacing of element and mast vs. radiation resistance. (B) Element end-to-end spacing vs. gain. (C) Center-to-center spacing of element and mast vs. gain.

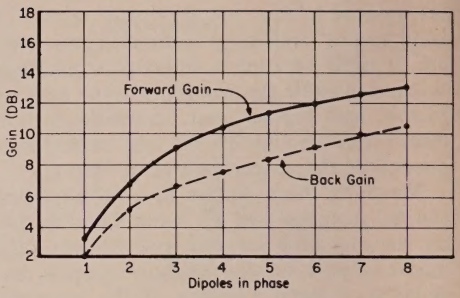

Fig. 6 — Gain vs. number of dipoles in phase (0.22 λ from mast; 0.48 λ end-to-end).

with exposed braid, dielectric and inner conductors flush, and the outer braids bound with #22-24 bare copper wire and soldered — *fast*, to avoid melting the polyethylene dielectric. It will soften, but should not deform. After cooling, the inner conductors are bent toward and joined to each other in a simple Y, and soldered with a *minimum* of solder. A big glob here will significantly increase the s.w.r.

IMPORTANT: Add 5/8″ for dipole termination, and about 7/16″ for splicing, to the calculated length of the dipole matching sections, and add 7/16″ *at each end* of the distribution matching sections for splicing, for the four element version.

With the dipoles mounted 0.9 wave apart on the mast, the matching sections are five quarter waves long. If the four dipole version is built, the two distribution matching sections must be seven quarter waves long. There will be extra coax to stow away, but with generous loops coming out of the support arms, and the splices looped upward for drainage, the coax is used up. The feed line and all matching sections are taped or secured neatly to the mast on the side opposite the dipoles. All splices, after spraying must be taped to keep out rain, etc. Ordinary drugstore corks are inserted in the top dipole elements, but bottoms are left open.

The sketches show all pertinent dimensions, splicing and connection details. The diagram shows a number of harness configurations, but familiarity with the procedure will provide others in addition to those shown.

The harness of matching sections can be used in reverse to feed a number of receivers from one pre-amplifier, or a common feed line. The procedure is exactly the same as for feeding multiple dipoles, and a significant

[*Continued on page 116*]

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For more than a year now, American manufacturers and distributors of amateur radio equipment have been faced with a growing challenge from imported products, which in most cases are being sold on a direct basis from importer to user.

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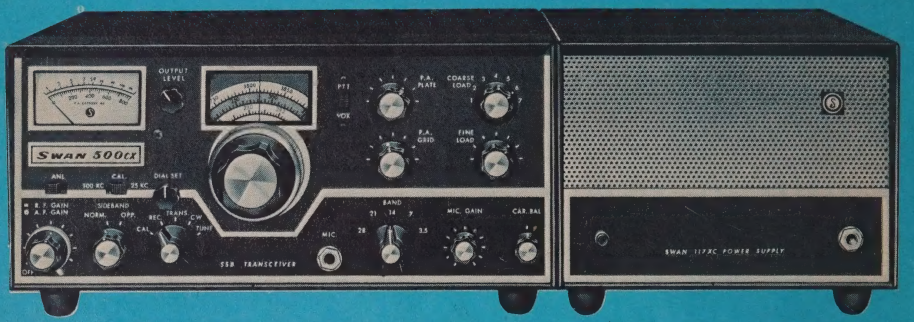
500CX



550 WATT 5 BAND SSB-CW-AM TRANSCEIVER

SPECIAL DESIGN FEATURES

All Swan Transceivers feature single conversion which results in greatly reduced image and spurious response. The successful application of this design is made possible by the unique combination of a high frequency IF system and a multi-range variable frequency oscillator. The only thing better than single conversion is no conversion at all.

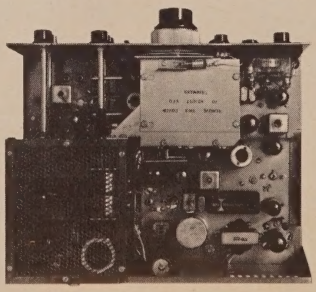
Selectivity is provided by a high frequency crystal lattice filter second to none. The 5.5 mHz carrier frequency and 2700 Hz bandwidth were carefully selected for optimum results. Swan's 5.5 mHz design produces the optimum shape factor, steepest skirts and greatest ultimate rejection. The more commonly used 9.0 mHz filters simply cannot provide comparable skirt selectivity or ultimate rejection of strong adjacent signals. The 2.7 kHz bandwidth was chosen for maximum readability of voice under conditions of noise, and QRM. As this bandwidth is reduced the transmission and reception of intelligence is rapidly depreciated. Swan Transceivers both transmit and receive audio which is virtually flat from 300 to 3000 Hz, resulting in truly natural sounding voice quality. This is why Swan Transceivers consistently sound better than others which pass 300 to 2400 Hz or less.

Superior selectivity is available with the optional SS-16 filter. This is a special 16 pole network designed exclusively for Swan by CF-Networks. A shape factor of 1.28 to 1 and ultimate rejection greater than 140 db provide the highest degree of selectivity ever offered in amateur or commercial gear. Bandwidth is the same 2700 Hz as the standard Swan filter, for the same reasons of high voice quality and readability under adverse conditions.

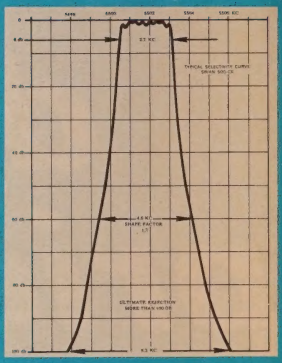
$449

Sensitivity of the Swan receiver circuitry is second to none. Using the best vacuum tubes available for the R. F. amplifier, signal to noise ratios run as high as the state of the art permits, without the inherent overload problems found in solid state receivers. The new automatic gain control circuit employed in the 500CX further reduces cross modulation and front end overload to extremely low levels.

The Velvet Tuning dual-ratio planetary dial drive in the 500CX is without question the smoothest system you'll find. It is virtually free of backlash!



TOP VIEW



SWAN'S HIGH FREQUENCY CRYSTAL LATTICE FILTER

There are 3 important factors about a filter which determine the overall performance. One of these is its 6 db Bandwidth. After careful examination, we selected 2.7 kHz in order to give you good channel separation, maximum intelligence, while retaining the smooth, natural audio for which Swan Transceivers are famous.

The next consideration is shape factor, or the ratio between bandwidths at 6 and 60 db points on the skirts. Because best shape factor can be achieved at approximately 5 mHz, we selected 5.5 mHz for the Swan I.F. Due to this I.F. Frequency selection, the Swan filter gives you a "shape factor" of 1.7 to 1, which is substantially better than the 2 to 1 ratio of the mechanical filter. The third factor, but by no means the least important, is the measure of ultimate rejection, or how far the skirts fall before flaring out. Ultimate rejection determines how well your receiver attenuates those strong adjacent channel signals, particularly the guy down the street with the big linear. In this respect, the Swan filter is superior to others being used in amateur sideband gear. Take a look at the graph and you'll see that this is better than 100 db with the Swan filter.

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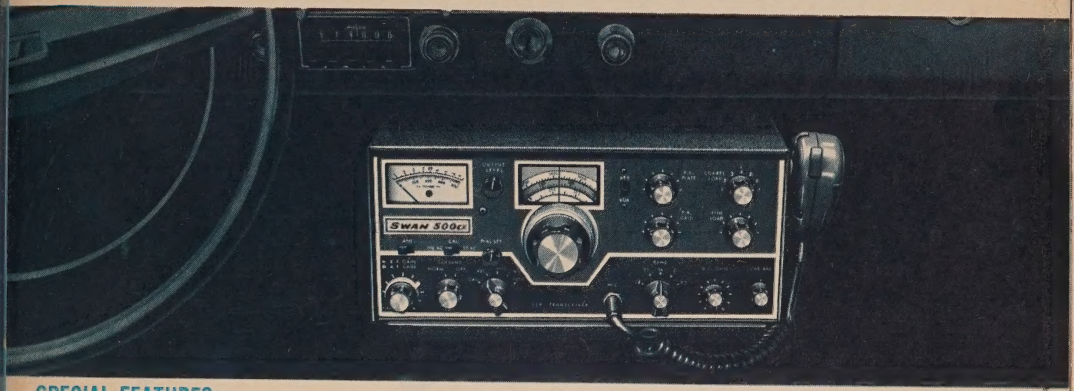


SPECIAL FEATURES:

- Power rating increased to 550 watts P.E.P. input.
- New amplified Automatic Gain Control circuit. Faster attack results in exceptional receiver control with no "pumping" effect.
- Amplified Automatic Level Control provides greatly improved transmitter control, reduces flat-topping, makes Mic. Gain adjustment less critical.
- New solid state crystal calibrator provides choice of markers every 25 kHz or 100 kHz.
- Improved Balanced Modulator circuit increases carrier suppression to well beyond the 60 db rating.
- New Product Detector circuit reduces distortion products and provides greater audio power output.
- Narrow band CW filter, accessory model AF-800, available for improved CW reception.
- Improved sidetone oscillator with pleasant sounding sine wave for CW monitoring.

GENERAL SPECIFICATIONS:

- Frequency range: 3.5-4.0 mHz, 7.0-7.45 mHz, 14.0-14.45 mHz, 21.0-21.45 mHz, 28.0-29.7 mHz.
- Extended frequency coverage for MARS operation with plug-in crystal oscillator accessory, model 510X.
- 5.5 mHz quartz crystal filter. Finest in the industry. 2700 Hz bandwidth, 1.7 to 1 shape factor at 6 and 60 db, more than 100 db ultimate rejection.
- Selectable Upper and Lower Sideband.
- Solid state VFO, highest stability, temperature and voltage compensated.
- 13 vacuum tubes, 7 transistors, 11 diodes.

TRANSMITTER SPECIFICATIONS:

- Power Rating: 550 watts, P.E.P. Input, 360 watts CW input, 125 watts AM input. Two 6LQ6 tubes.
- Suppression: Unwanted sideband down more than 50 db, carrier down more than 60 db, third order distortion down approx. 30 db.
- Audio Bandpass: 300 to 3000 Hz, ±3 db.
- Output Circuit: Wide range Pi, coarse and fine adjustment.
- Amplified ALC, increased voice power.
- Automatic voice controlled transmit with plug-in VX-2 accessory.
- CW keying, grid-block system, off-set transmit frequency.
- Break-in CW operation with plug-in VX-2 accessory.

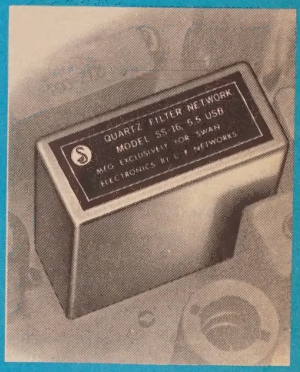
RECEIVER SPECIFICATIONS:

- Sensitivity: Requires less than ½ microvolt at 50 ohms for 10 db S + N/N ratio.
- Precision Tuning: Velvet smooth, dual ratio, zero backlash. The finest tuning system on the market.
- Audio fidelity: 300 to 3000 Hz, ±3 db.
- Amplified AGC, fast attack, no pumping, controlled decay.
- S-Meter circuit functions automatically in receive mode.
- Automatic Noise Limiter, with panel on-off switch.
- CW Sidetone circuit for monitoring CW Keying.

POWER SUPPLY REQUIREMENTS:

- For 117 volts, 50-60 Hz: Swan model 117-XC, includes speaker.
- For 117-230 volts, 50-60 Hz: Swan model 230-XC, includes speaker.
- For 12-14 volts DC: Swan model 14-117. (Also operates on 117 volts AC.)
- For 12-14 volts DC: Swan model 14-230. (Also operates on 117-230 volts AC.)

SHARP AS A LASER



THE SWAN MODEL SS-16 QUARTZ FILTER NETWORK

Now available to provide super selectivity for your Swan Transceiver. Easily installed in models 240, 260, 270B, 350, 350C, 400, 500, and 500CX.

- **Unprecedented rejection of adjacent channel QRM.**
- **2.7 kHz bandwidth at 6 db down.**
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- **Ultimate rejection: —140 db.**
- **16 poles. 16 precision crystals in a lattice filter network.**
- **Sideband suppression: —80 db.**
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- **Mounting: Same as standard Swan filter, 2¾" high.**

with instructions. Specify transceiver model.

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Power supplies

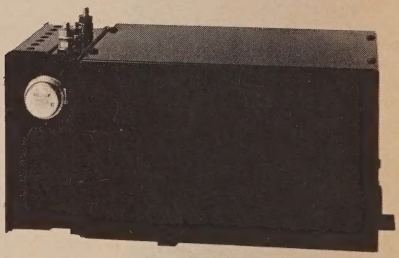
AC POWER SUPPLY
MODEL 117-XC

A complete A.C. supply for 117 volts, 50-60 hz in a matching cabinet with speaker, phone jack, and indicator light. Complete with A.C. cord and prewired plug ready to connect to transceiver. Size: 8 inches x 5¼ inches high x 11 inches deep. Weight: 21 pounds. Model 230-XC 230 VAC 50-60 hz version of the 117-XC. **$95**

COMPLETE 12 VOLT DC POWER SUPPLY
MODEL 14-117

For mobile operation. Consists of an AC power supply, model 117-X (or 230-X) and a D.C. converter, Model 14-C. The 117-X is mounted in the car and the 14-C attaches to the 117-X. By detaching the 14-C the power supply may be operated from an A.C. line by simply plugging in the A.C. cord. Comes complete with all cables, fuses, and hardware (less A.C. line cord). Total size with the 14-C attached, 5 inches x 5 inches x 12¼ inches. Weight: 16½ pounds.

Model 14-117 (12-14 volt DC/117 volt AC) $118
Model 14-230 (12-14 volt DC/117-230 volt AC)..$124
Model ACL—AC line cord for 14-117..... $8



BASIC A.C. POWER SUPPLY
MODEL 117-X

A complete A.C. supply, but in a plain black box. Does not include matching cabinet, speaker or cable. 5 inches x 5 inches x 8¾ inches. Weight: 14 pounds. **$59**

MODEL 230-X

for either 230 or 117 volts A.C. input. **$65**

MODEL 14C

Converts 117-X or 230-X to 12 volt DC input, negative ground. Includes cable, plugs, fuses, and mounting hardware. 5 inches X 5 inches X 8⅓ inches. Weight: 2½ pounds. **$5**

MODEL 14CP

Same as model 14C, for positive ground. **$5**

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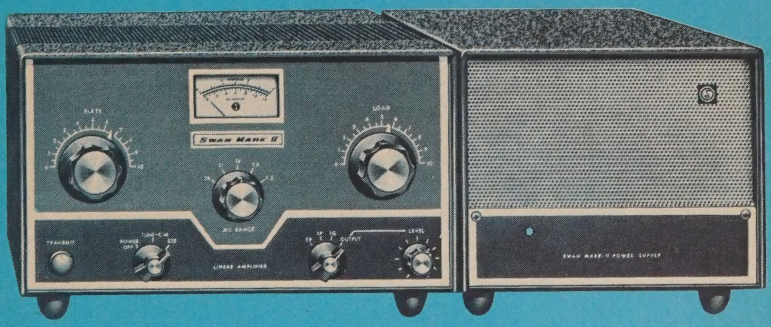
Mark II Linear Amplifier



2000 WATTS P.E.P.

The Mark II Amplifier provides full frequency coverage of the amateur bands from 10 through 80 meters, and also MARS frequencies. Two Eimac 3-500Z Triodes easily provide the full legal power input: 2000 Watts P.E.P. in SSB mode or 1000 Watts AM, CW, or RTTY. It may be driven by any transceiver or exciter having between 100 and 300 watts output.

Planetary vernier drives on both plate and loading controls provide precise and velvet smooth tuning of the amplifier. Greatly reduced blower noise is provided by a low RPM, high volume fan.

Complete with Tubes and matching power supply. **$499**

SPECIFICATIONS

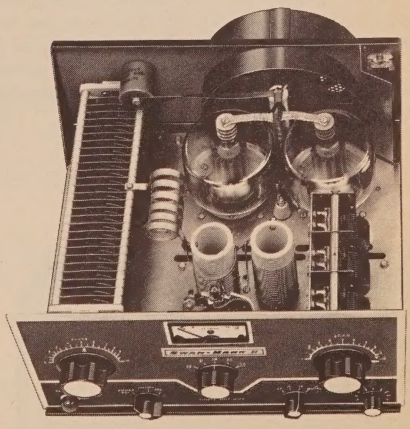
- Two Eimac 300-500Z zero bias triodes in grounded grid circuit.
- Conservative power ratings: 2000 watts P.E.P. input, 1000 watts CW-AM and RTTY input.
- Full frequency coverage of amateur bands 10-80 meters plus MARS frequencies.
- Wide range pi network in output tank circuit.
- Drive requirements: 100 to 300 watts.
- Includes antenna changeover relay
- Ceramic insulation on all tuning capacitors and RF switches.
- Planetary vernier drives on both plate and loading controls.
- Low RPM, high volume fan operates almost silently.
- Dimensions: 13 in. wide, 8 in. high, 14 in. deep.
- Weight: 20 lbs.

MATCHING POWER SUPPLY

The power supply is a separate matching unit which may be placed beside the Mark II Amplifier, or with its 4½-foot connecting cable, may be placed on the floor. Component quality is of the highest caliber. Silicon rectifiers deliver 2500 volts D.C. in excess of 1.2 amperes. Computer grade electrolytic filters provide 40 mfd capacity for excellent dynamic regulation. A quiet-running fan allows continuous operating with minimum temperature rise, extending the life and reliability of all components.

POWER SUPPLY SPECIFICATIONS

- Input voltage may be either 117 or 230 volts AC, 50-60 Hz. (230 VAC operation recommended.)
- Silicon rectifiers deliver 2500 volts DC in excess of 1.2 amperes.
- Computer grade electrolytic filter capacitors. 40 mfd net capacity.
- Self-contained fan for cool, continuous operation.
- 9 in. wide, 8 in. high, 14 in. deep.
- Weight: 35 lbs.



TOP VIEW

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External VFO and Phone Patch

MODEL 508 MODEL 117XC MODEL 500CX

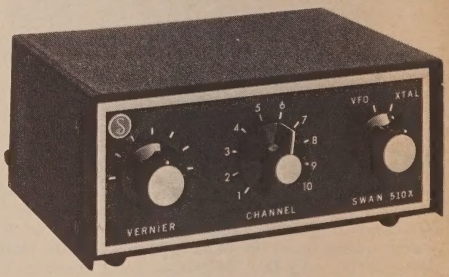
MODEL 508 EXTERNAL VFO

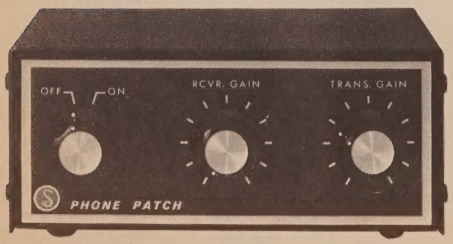
Provides facilities for transmitting and receiving on separate frequencies. It plugs directly into the back of the 500-CX. A front panel control permits instant selection of 3 modes: (a) transceive on 500-CX VFO, (b) transmit on 500-CX VFO and receive on 508 VFO. (c) or transceive on 508 VFO.

Full coverage is provided on the 10, 15, 20, 40, and 80 meter bands, with 10 meters divided into 4 segments for improved vernier control and frequency readout. The tuning dial is calibrated in 5 khz increments, while the vernier dial is calibrated in 1 kc increments. The 508 has the same velvet-smooth dual-planetary tuning as the 500-CX. $129

MODEL 510X CRYSTAL OSCILLATOR

For MARS operation outside the amateur bands, and for net operation in the 80, 40, 20, and 15 meter bands. A ten position switch allows selection of up to ten crystal frequencies, with Vernier control for adjustment to exact frequency. Plugs directly into the 500-CX. Mode switch permits choice of crystal or VFO control. $44



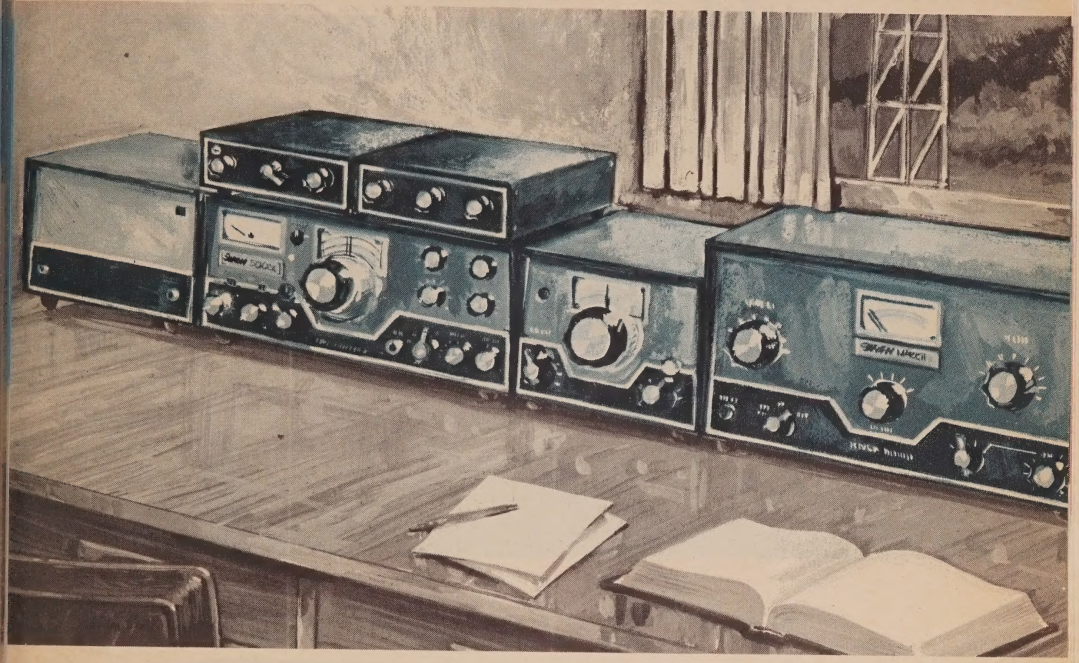


MODEL FP-1 PHONE PATCH

Designed to connect easily and quickly to the 500-CX and your telephone so that the party on the other end of the telephone line can listen and talk over the radio circuit. May also be used with any transceiver or receiver transmitter combination. $39

Swan leads the field again! With factory direct prices!

Swan Accessories



VOX UNIT

Provides Voice Operated Transmit control. Plugs directly into 500CX, 270B and 250C.

Model VX-2 ..... $29

Model NS-1 Noise Silencer $29

For Model 250C only.

CW FILTER

Narrow band CW filter. Installs inside AC power supply, with panel control for switching in and out. Provides the sharp selectivity required for CW operation. Centered at 800 cycles, bandpass from approx. 550 to 1050 cycles.

Model AF-800 ..... $29

SWAN HAND MICROPHONE $17.95

SWAN DESK MICROPHONE $24.95

SPEAKER & CABINET COMBINATION

Fits the Swan 117X or 230X basic AC supplies.

Model S/C 117 or S/C 230 ..... $29

UNIVERSAL MOBILE MOUNTING KIT

for installing transceiver under dash or over transmission hump.

Model MTK $9

AC LINE CORDS

Model 117 L/C for 117 volt $8

Model 230 L/C for 230 volt $8

MODEL SPC

8 foot secondary power cord, with Jones plug $6

Swan Prepays Freight!*

(*See order page for details.)

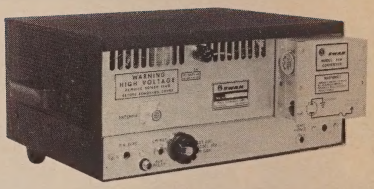
Deluxe *Cygnet* 270B

SSB TRANSCEIVER
5 BANDS—260 WATTS
WITH BUILT-IN AC POWER SUPPLY AND LOUDSPEAKER

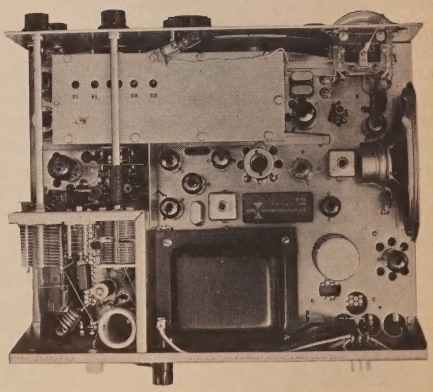
The deluxe Cygnet is a complete amateur radio station beautifully integrated into one package. It contains all the features required for home station operation with enough power to work the world. Its surprising low cost is a result of our continuing program of value engineering.

The lightweight, compact design of the Deluxe Cygnet makes it an ideal traveling companion. You can take it with you on your vacation or business trip, and operate from your motel room, summer cabin, boat or car. All you do is connect to an AC power source, plug in your microphone, and antenna—you're on the air. Twelve volt DC operation may be obtained by using the optional plug-in accessory, Model 14A DC converter.

The Swan Deluxe Cygnet is the most versatile and portable transceiver on the market, and certainly the best possible value. **$399**



REAR VIEW



TOP VIEW

14A DC

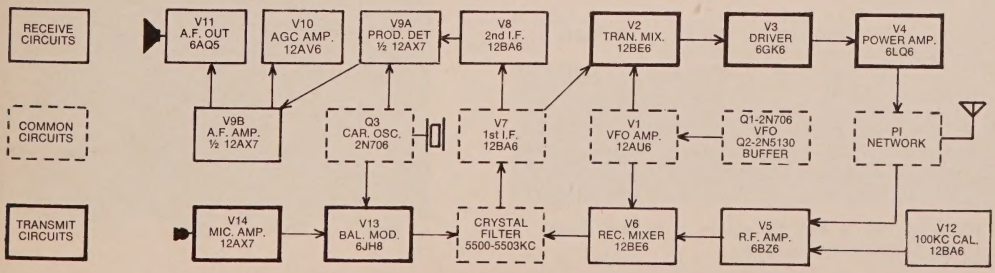
Model 14A DC Converter
Shown in rear view above $29

Swan quality at import prices!

Portable...Versatile

Cygnet 270B SPECIFICATIONS

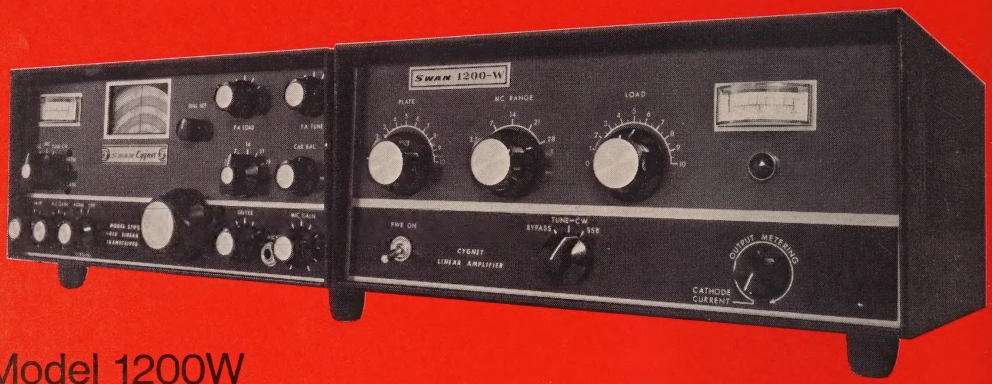
- Power Input: 260 watts P.E.P. SSB and 180 watts CW
- Frequency Range: 3.5-4.0 mHz, 7.0-7.3 mHz, 14.0-14.35 mHz, 21.0-21.45 mHz, 28.0-29.7 mHz
- C.F. Networks: Crystal Lattice Filter. Same as used in the Swan 500 CX 2.7 kc with 1.7 to 1 shape factor. Ultimate rejection exceeds 100 db
- Unwanted sideband suppressed 50 db
- Carrier suppressed 60 db. 3rd order distortion down approx. 30 db
- Audio Response: flat within 3 db from 300 to 3000 cycles in both transmit and receive modes
- Pi Antenna coupler for 50 to 75 ohm coaxial cable
- Grid Block CW keying with off-set transmit frequency
- Solid state VFO circuit temperature and voltage stabilized
- Receiver sensitivity better than ½ microvolt at 50 ohms for 10 db S + N/N ratio
- 100 kc Crystal Calibrator and dial-set control
- S-meter for receiver, P.A. Cathode meter for transmitter tuning
- Improved AGC and ALC circuit. Separate R.F. and A.F. gain controls
- Sideband selector
- Provision for plug in of VOX unit, external VFO, headphones, and Cygnet Linear
- Tube Complement: 12AU6 VFO amp., 12BE6 trans. mixer, 6GK6 driver, 6LQ6 pwr. amp., 6BZ6 rec. R.F., 12BE6 rec. mixer, 12BA6 1st I.F. amp., 12BA6 2nd I.F. amp., 12AX7 prod. det. A.F. amp., 6AQ5 A.F. output, 12AX7 mic. amp., 6JH8 bal. mod., 12AV6 AGC-ALC amp., 12BA6 xtal, cal.
- Voltage Input: 117 volts 50-60 Hz. Available on special order for 208-220-240 volts.
- For 12-14 volt DC operation, a plug-in converter, model 14-A, is available. This unit is only 1½x3x4 in., and plugs onto the back of the 270B in place of the AC power connector.
- Dimensions: 5½ in. high, 13 in. wide, 11 in. deep. Net weight: 24 lbs.



BLOCK DIAGRAM 270B

Swan leads the field again! With factory direct prices!

Matching *Cygnet* linear amplifier



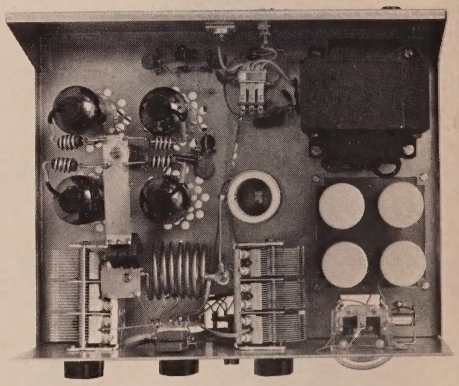
Model 1200W

1200 WATT MATCHING AMPLIFIER WITH SELF-CONTAINED AC POWER SUPPLY

For those times when the quarter kilowatt of the model 270B transceiver isn't quite enough to break through, the Cygnet Amplifier provides a 5 times increase in power. Utilizing a grounded grid, super-cathode-drive circuit, both efficiency and linearity are exceptionally high. In a matching cabinet which includes the AC power supply, as shown above, the 1200-W makes a most attractive companion for your Cygnet transceiver. It plugs directly into the Model 270B. **$189**

SPECIFICATIONS

- Power Rating: 1200 watts P.E.P. input. 800 watts CW input, 300 watts, AM input. Covers 80, 40, 30, 15, and 10 meters. Four 6LQ6 tubes operating as grounded grid triodes.
- Third order distortion down approximately 30 db. Pi output tank for 50 or 75 ohm coaxial antenna feed.
- Computer grade electrolytic filter capacitors. Silicon diode rectifiers. Complete with interconnecting cables, ready to plug into the 270B and operate, 117 volts, 50-60 Hz input. Available on special order for 208-220-240 volts.
- Dimensions: 5½ in. high, 13 in. wide, 11 in. deep. Weight: 25 lbs. (Carrying handle included)



TOP VIEW

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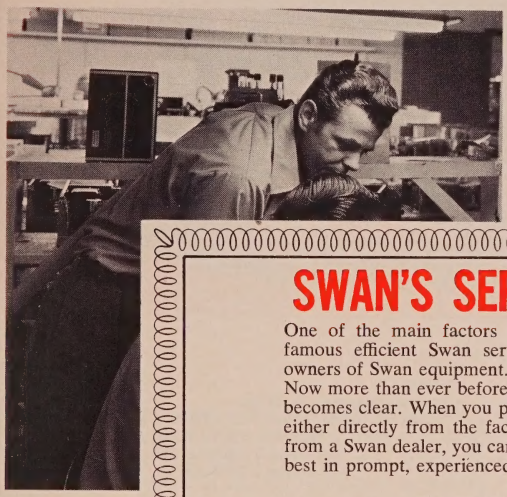
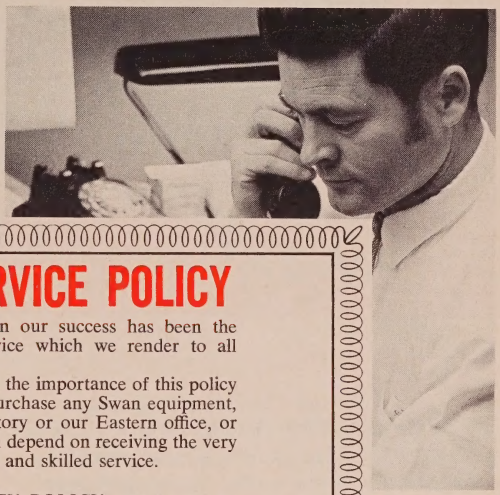
Service

ALL SWAN PRODUCTS ARE COMPLETELY BACKED BY A SERVICE POLICY AND WELL STAFFED FACTORY SERVICE DEPARTMENT THAT ARE SECOND TO NONE!



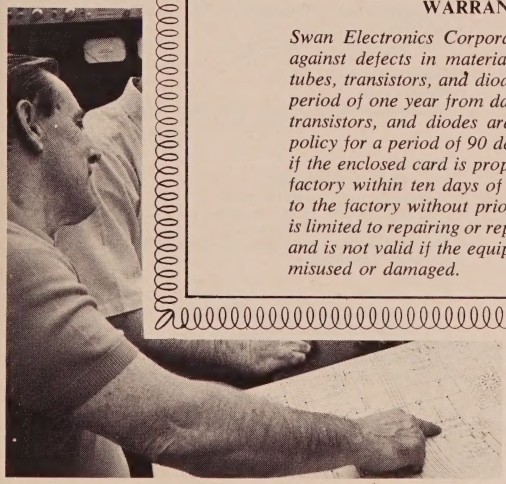


SWAN'S SERVICE POLICY

One of the main factors in our success has been the famous efficient Swan service which we render to all owners of Swan equipment.
Now more than ever before, the importance of this policy becomes clear. When you purchase any Swan equipment, either directly from the factory or our Eastern office, or from a Swan dealer, you can depend on receiving the very best in prompt, experienced and skilled service.

WARRANTY POLICY

Swan Electronics Corporation warrants this equipment against defects in material or workmanship, except for tubes, transistors, and diodes, under normal service for a period of one year from date of original purchase. Tubes, transistors, and diodes are covered under the warranty policy for a period of 90 days. This warranty is valid only if the enclosed card is properly filled in and mailed to the factory within ten days of date of purchase. Do not ship to the factory without prior authorization. This warranty is limited to repairing or replacing only the defective parts, and is not valid if the equipment has been tampered with, misused or damaged.



ASK THE HAM WHO OWNS ONE!

Swan's service policy is still second to none!

NEW!!! TWO METER FM TRANSCEIVER

FM-2X

VHF FM TRANSCEIVER FOR 2 METERS

NO COMPROMISE 2 METER PERFORMANCE.

The all new Swan FM-2X has been a long time in the making, but we wanted to offer you the finest in performance and quality at a price all can afford. The Swan FM-2X features all solid state construction (no final tubes to waste battery power), and comes complete with microphone, AC power supply and mobile mounting bracket. The FM-2X is being built to our specifications by a highly respected Japanese manufacturer of commercial communications equipment. Needless to say, the FM-2X is backed by the famous Swan service policy.

$229

SPECIFICATIONS:

General

- **Frequency Coverage:** 144-148 MHz
- **Number of Channels:** 12 Channels, 3 supplied.
  Channel 1 146.94/146.94
  Channel 2 146.34/146.94
  Channel 3 146.34/146.76
- **Modulation:** Frequency Modulation
- **Transmitter Control:** Push to talk.
- **Power Source:** AC: 117 volts 50/60 Hz
  DC: 13.5 Volts ±10%

Dimensions: 8¼" x 7" x 3"

- **Weight:** 8¼ lbs.
- **Standard Accessories:** Dynamic Microphone, Antenna, Connector Plug, AC/DC Cord.

Transmitter

- **FULLY SOLID STATE, NO TUBES.**
- **RF Output Power:** 10 watts minimum.
- **Frequency Deviation:** 15 KHz maximum.
- **Frequency Stability:** ±.001% or less.
- **Spurious Radiation:** Greater than −60 db below Carrier.
- **Frequency Multiplication:** 12

Receiver

- **Receiver Circuit:** Crystal-controlled Double Conversion Superheterodyne.
- **Intermediate Frequencies:** 1st 10.7 MHz, 2nd 455 kHz.
- **Input Impedance:** 50 to 75 Ohms.
- **Sensitivity** 5μV for 20 db quieting. .5μV for 12 db SINAD.
- **Intermodulation:** Greater than 60 db.
- **Audio Output:** 2 watts to internal speaker.

Swan quality at import prices!

VHF 150

2 METER FM AMPLIFIER

Here in one complete package is a 150 watt self-contained amplifier. Use for home station, or with the addition of the Swan **14C DC** converter, the unit may be used in mobile operation to greatly extend the range of direct communications

$249

SPECIFICATIONS:

- **Power Rating:** 180 watts P.E.P. input SSB.
  150 watts DC input on CW or FM.
- **Frequency Range:** 143-149 mc. Uses 5894B twin tetrode.
- **Drive Requirements:** Approx. 2 watts for full output.
- **Meter Selector:** Reads plate current and relative output. Includes transmit and receive relay control for simple operation with a transceiver. Pi coupling adjusted at factory for 50 ohms.
- **Power Supply**
  Built-in 117 or 230 VAC input with proper line cord. Also DC operation with addition of 14 C DC module.
- **Dimensions:** 13 in. wide x 5¾ in. high x 10¾ in. deep.
- **Weight:** 23 pounds.

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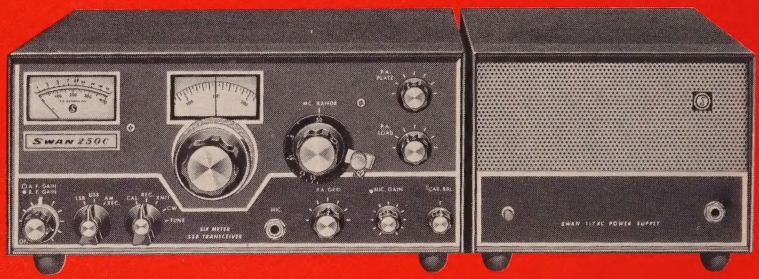
Swan Prepays Freight!*

(*See order page for details.)

250C for 6 meters



SSB-CW-AM TRANSCEIVER FOR 6 METERS—240 WATTS P.E.P.

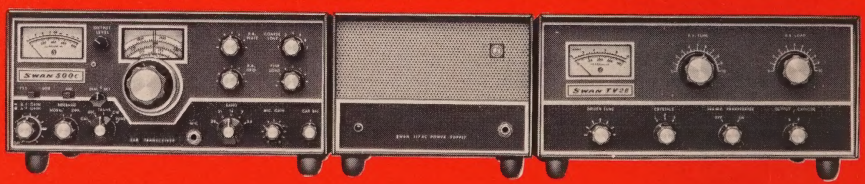
Engineered to provide the same excellent voice quality, power, and performance that have become the trademark of all Swan transceivers. With the Swan 250C, there is practically no limit to the operating pleasure you can find in the 6 meter VHF band.

$399

SPECIFICATIONS

- Frequency Range: 50-54 mHz
- Power Rating: 240 watts P.E.P. Input in SSB mode, 180 watts CW Input, 75 watts AM input
- Two 6146 B Power output tubes
- Distortion Products: approx. —30 db
- Unwanted Sideband: —40 db
- Carrier Suppression: better than —50 db
- Receiver Noise Figure: Better than 3 db, with two 6CW4 nuvistors in Cascode.
- Selectivity: 2.8 KC at 6 db down, with crystal lattice filter at 10.9 MC.
- Antenna Matching: Wide range Pi network
- Metering circuits: S-meter on Receive mode, P.A. Cathode Current and relative output in transmit mode
- 250 KC Crystal calibrator
- Selectable upper and lower sideband
- Receiver Mode switch provides AM reception
- Accessory sockets for noise silencer, external VFO and VOX unit

TV-2B transverter for 2 meters



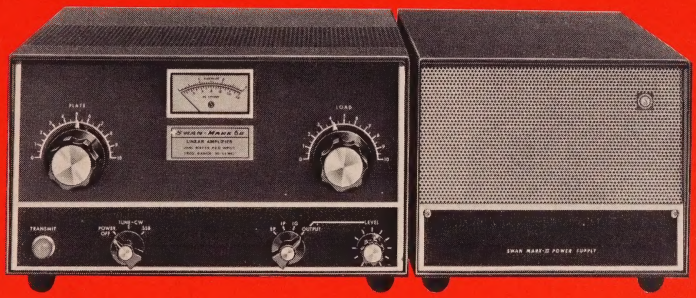
A RECEIVING AND TRANSMITTING CONVERTER FOR THE 2 METER BAND

Designed to convert any Swan Transceiver to operate on the 2 meter band. Requires just one power supply for both units. 240 watts P.E.P.

$289

Swan Speaks Your Language! Now more than ever.

Mark 6B



SWAN MARK 6B 2000 WATT P.E.P. LINEAR AMPLIFIER FOR 6 METERS

SPECIFICATIONS:

Power Rating: 2000 Watts P.E.P. Input in Single Sideband Mode. 1000 Watts DC input on CW AM or RTTY.

FREQUENCY RANGE: 50-54 mHz. Uses two Eimac 3-500Z Grounded Grid Triodes.

Drive Requirement: 100 Watts for maximum legal input.

Meter Selector: Plate Voltage, Plate Current, Grid Current, and Relative Output. Includes Transmit-Receive Relay Control for simple operation with a Transceiver. Wide range Pi Output Circuit matches 52 or 75 ohm coax cable or variety of other load impedances.

Dimensions: 13″ wide x 7″ high x 12″ deep.

Weight: 20 lbs.

Complete with tubes and power supply. **$499**

POWER SUPPLY

Matching unit may be operated next to Amplifier as illustrated, or with its 4½-foot connecting cable, may be placed on the floor.

Computer grade electrolytic capacitors, 40 mfd. filtering at 2500 VDC. Silicon Rectifiers. AC input: 117 or 230 volts, 50-60 Hz. Includes quiet running fan for cool operation of all components.

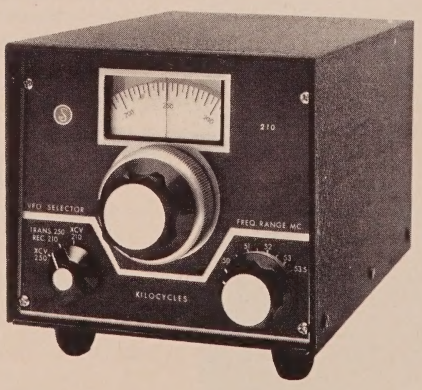
Dimensions: 9″ wide x 8″ high x 14″ deep.

Weight: 35 lbs.

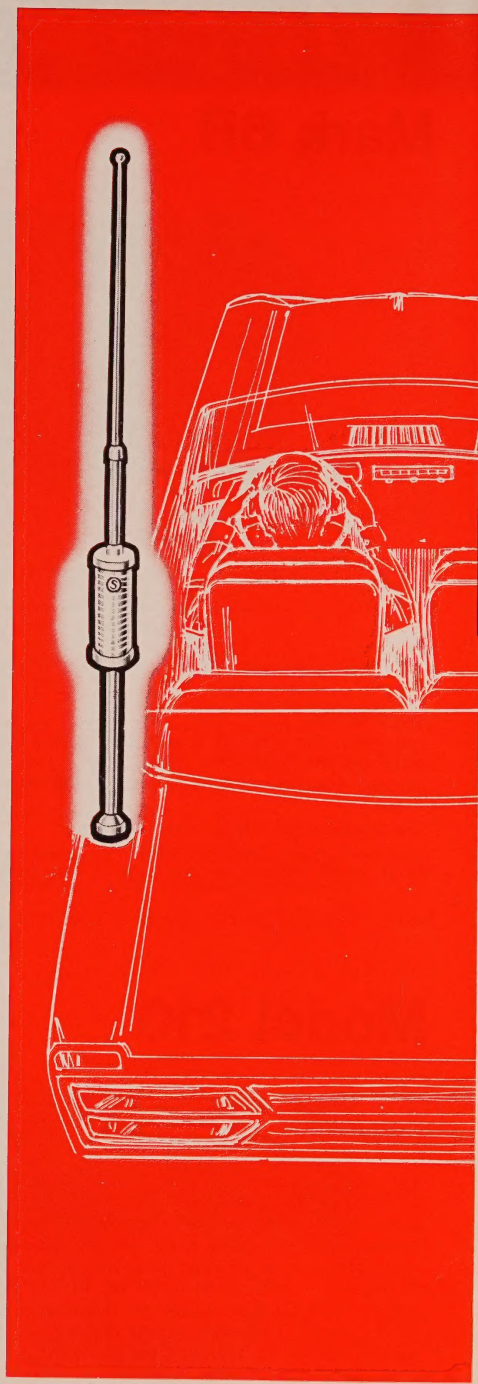
Model 210

MODEL 210 FREQUENCY CONTROL UNIT FOR 6 METERS

Model 210 Frequency Control Unit is designed for full coverage of the 50-54 mHz band when used with the model 250 transceiver. The unit matches the 250 in height, depth, and styling. Relay switching is built-in, and a selector knob on the front panel provides for selection of frequency control. In position 1 the VFO in the 250 is used for both transmit and receive. In position 2 the 250 VFO is used for transmit and the external 210 VFO is used to receive. In position 3 the 210 VFO is used for both transmit and receive. **$99**



Mobile antennas



HIGH Q—HIGH EFFICIENCY

Try measuring the wire size, coil diameter, and coil length of your loading coil. If the figures are not as large as the Swan loading coil, then radiation efficiency cannot and will not be as high. It's as simple as that.

A mobile antenna is, of necessity, a compromise. It takes a loading coil to make it look like a quarter wave vertical. Radiation efficiency is related directly to the Q of the loading coil. Q is a figure of merit which is the reciprocal of equivalent series resistance in the coil. It is this resistance which dissipates power. Obviously, the smaller this equivalent series resistance is, the smaller coil losses will be.

Theoretically, with infinite Q, the coil would have no loss, and the antenna would be as efficient as a full size vertical. This isn't possible, so we have to settle for something less. But, how much of your transceiver power are you willing to lose in heating up the coil? It takes a lot of amps from your battery to generate that 300 watts of RF power. We build transceivers too, (in case you hadn't noticed), and we hate to see them warming up those inefficient loading coils. Next time you load up your rig, feel the coil on your antenna. Warm? Those are wasted watts. That power should be radiated instead, to help break through QRM. This is why you'll find the Swan mobile antenna line with really high Q coils.

The coils are so handsome, we think you'll want to show them off, so the weather shield is transparent. Notice that other brands are covered up. Is this to make them prettier? Or is it to hide the small, close wound wire. Don't let anyone kid you. The smaller coils are not nearly as efficient. A laboratory Q meter will prove this quickly. But, if you don't have access to a Q meter, try the tape measure test.

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Models 35, 45 and 55

SINGLE BAND MODEL 35

For maximum radiation efficiency, our single band design is the best. If you're a one-band operator, or don't change bands very often, this is the model for you. Heavy duty construction is one of the highest possible quality. Stainless steel whip has Kwik-On connector, also for easy removal and stowage. Power rating is 2000 watts P.E.P.! Heavy duty base sections of various lengths permit choice of deck or bumper mounting.

Top section, 5 ft. Whip	11.95	75 Meter Coil	27.95
15 Meter Coil	21.95	18 inch Base Section	8.50
20 Meter Coil	23.95	36 inch Base Section	8.95
40 Meter Coil	25.95	48 inch Base Section	9.50

Prices include Kwik-on Connectors

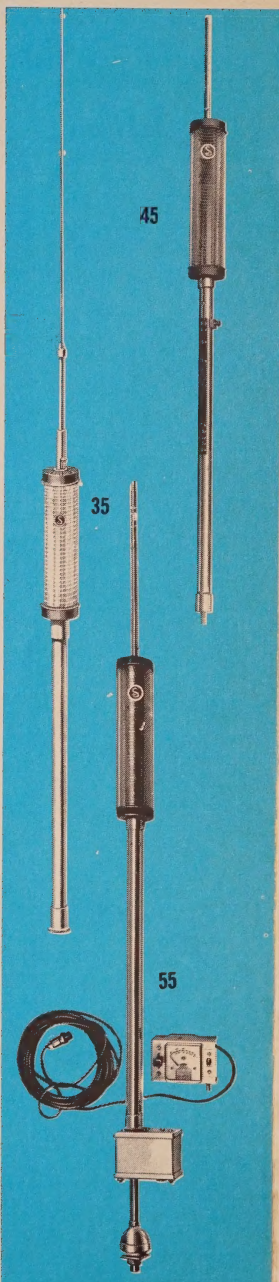
5-BAND MANUAL SWITCHING MODEL 45

No coil changing with this model, it covers 10, 15, 20, 40, and 75 meters. Gold plated contacts on the patented* vertical switch provide 5 stops for full coverage of the 75 meter phone band. High radiation efficiency is provided by the high Q coil, (same size as the single band coils). 1000 watts P.E.P. power rating. 5 foot whip comes with Kwik-On connector. Top quality throughout. $69

5-BAND REMOTE CONTROL MODEL 55

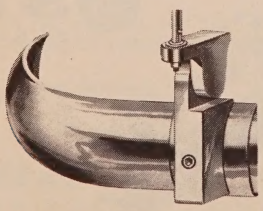
This is our most deluxe model, for the band hopping operator. A control box under the dash permits instant band changing while driving. Covers 10, 15, 20, 40, and 75 meters with the same patented* electrical and mechanical design as the manual model 45, but with motor drive and remote control. Finest quality construction, nothing has been spared to make this model the very best, and most efficient you can buy. Power rating is 1000 watts P.E.P. 5 foot whip comes with Kwik-On connector. $99

*Patent No. 2961657



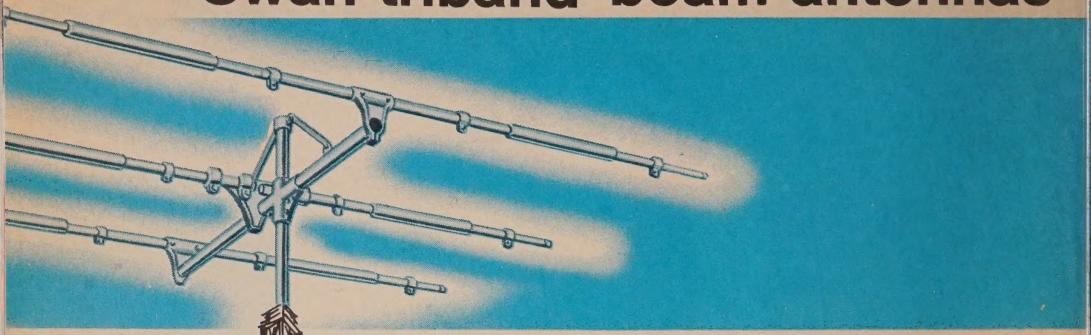
Deluxe Bumper Mount $24

Extra KWIK-ON Connectors
For quick removal of model 45 or 55.
All stainless steel construction. $6



SINGLE BAND PERFORMANCE WITH PATENTED* TUNEABLE TRAPS

Swan triband beam antennas

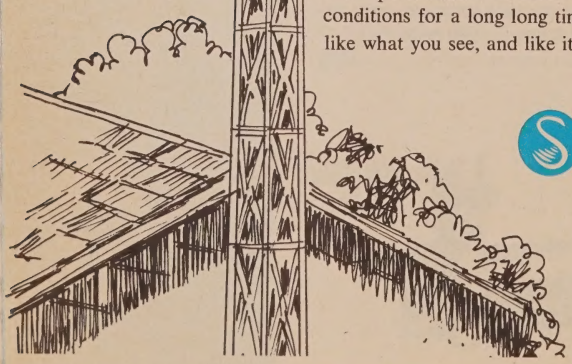


EXCLUSIVE FEATURES:

Swan Triband Beams feature a patented* trap design which permits precision factory adjustment. This results in maximum forward gain and front-to-back ratio from each and every Swan antenna. Their outstanding performance is comparable to single band antennas having the same number of elements.

The electrical principles employed in a trap type multi-band antenna are quite simple. The "trap" is a parallel resonant circuit consisting of a high Q inductance with a coaxial sleeve capacitor connected in parallel. At resonance the impedance across the trap is very high, and its effect is the same as inserting an insulator at that point. Thus, the electrical length of the antenna element can be altered by insertion of a parallel tuned trap. Each element in a Swan Triband Beam has two traps for 10 meters, and two traps for 15 meters. (None are required for 20 meters since the elements are full length on this band.) It is vitally important that the traps are tuned to exact frequency, or antenna performance will not be optimum. Normal manufacturing tolerances in the coil and capacitor assembly create considerable variation in resonant frequency. Unless the trap has some means for precise adjustment, its resonant frequency will be pretty much a hit or miss affair. The exclusive precision tuned traps in Swan antennas explain why they give consistently superior performance. 2000 watts P.E.P. power rating: All models of the Swan Triband Beams are rated at the full legal power limit.

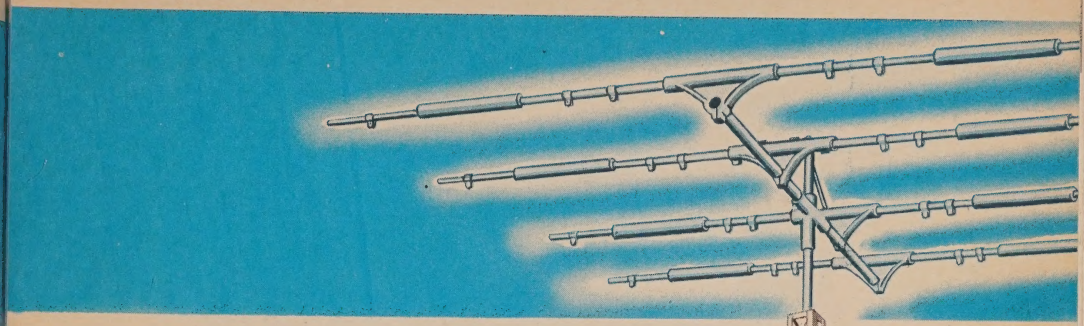
Low SWR. Swan Triband Beams are designed for a near perfect match on each band with 52 ohm coaxial cable. Standing wave ratio will be down as low as 1.2 at band center, resulting in extremely low transmission line loss. There are no gimmicks or gadgets in the feed system. It's very simple, and works very well. In fact, we offer no magic whatsoever in our antennas, except that they are designed to provide maximum performance on each band, and mechanically built to withstand severe weather conditions for a long long time. Ask any ham who owns one. We think you'll like what you see, and like its performance even more.



SWAN ELECTRONICS

*Patent No. 3064257

TB-4H



4 ELEMENT MODEL TB-4H

The Swan 4 Element Heavy Duty Triband Beam gives you 4 working elements on each band: 10, 15, and 20 meters. A 24-foot boom permits optimum spacing for maximum forward gain and front-to-back ratio. All traps have been precision tuned and weather proofed. The Heavy Duty mechanical design of the TB-4H means that it will easily take winds up to 100 mph, and provide years of reliable service in any kind of climate from the arctic to the tropics.

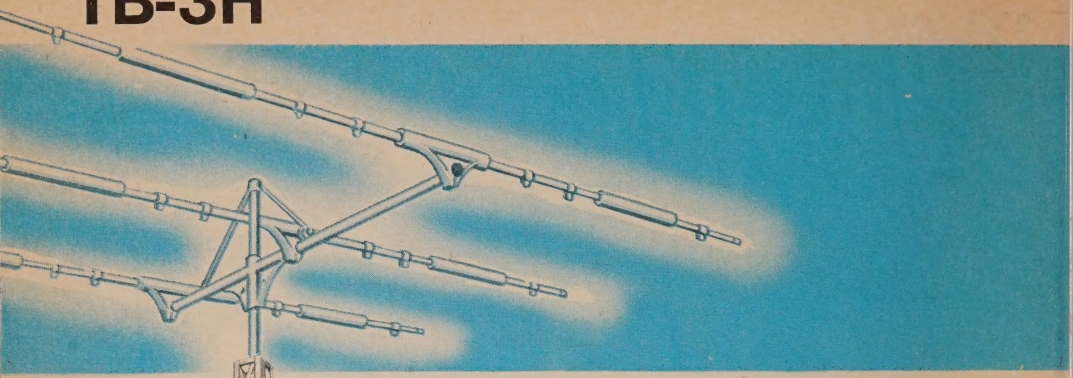
$119

SPECIFICATIONS

POWER RATING: 1000 watts, 100% amplitude modulated, 2000 watts P.E.P.
RESONANCE:
10 m—28.750—Field Adjustable to other Frequencies.
15 m—21.350—Field Adjustable to other Frequencies.
20 m—14.250—Field Adjustable to other Frequencies.
PATENTED ADJUSTABLE TRAPS: This exclusive feature permits exact adjustment for the desired portion of each band. Slim line construction, completely enclosed and weather sealed.
SWR AT RESONANCE: 1.2 maximum
FORWARD GAIN:
10 m
15 m } 9 db average
20 m
Note: Antenna gain is quite often a highly exaggerated claim. Generally speaking, actual antenna gain will be directly related to the length of the boom assuming normal antenna efficiency. Pound for pound, and foot for foot, the Swan-TB4H will equal or exceed the forward gain of any competitive design.
FRONT-TO-BACK RATIO: 26 db. average.
TRANSMISSION LINE: 52 ohm coaxial cable, standard PL-259 coaxial connector.
HARDWARE: Bolts, nuts and washers—bright cadmium plated.
ELEMENTS: Seamless 6061-T6 aluminum tubing; 1⅛" tapering to ¾".
BOOM: 1½" o.d x 24' heavy-wall, galvanized steel tubing.
ELEMENT TIPS: ¾" tubing with end caps.
TURNING RADIUS: 17'6"
WEIGHT: 64 lbs.
WIND LOAD, at 80 mph: 148 lbs.
MAXIMUM WIND SURVIVAL: 100 mph
MAST: Mast-to-boom fitting is machined to fit 1½" o.d. mast. 1¼" E.M.T. (measures 1½" o.d.) is readily available at all electrical contractors. (Mast not included.)
FITTINGS: Cast aluminum alloy. Heavy-duty precision machined.
OVER-HEAD BRACE RODS: Included.

SWAN
ELECTRONICS

TB-3H



3 ELEMENT MODEL TB-3H

Same Heavy Duty design as the TB-4H, but with 3 elements on a 16-foot boom.

$99

SPECIFICATIONS

POWER RATING: 1000 watts, 100% amplitude modulated, 2000 watts P.E.P.
RESONANCE:
10 m—28.750
15 m—21.350
20 m—14.250
PATENTED ADJUSTABLE TRAPS: This exclusive feature permits exact adjustment for the desired portion of each band. Slim line construction, completely enclosed and weather sealed.
ELEMENTS: Seamless 6061-T6 aluminum tubing; 1⅛" tapering to ¾".
BOOM: 1½ o.d. x 8' heavy-wall, galvanized steel tubing.
FRONT-TO-BACK RATIO: 16-18 db average.
SWR AT RESONANCE: 1.2 maximum.
FORWARD GAIN:
10 m, 15 m, 20 m } 5 db average.
Note: Antenna gain is quite often a highly exaggerated claim. Generally speaking, actual antenna gain will be directly related to the length of the boom assuming normal antena efficiency. Pound for pound, and foot for foot, the Swan-TB3H will equal or exceed the forward gain of any competitive design.
TRANSMISSION LINE: 52 ohm coaxial cable, standard PL-259 coaxial connector.
HARDWARE: Bolts, nuts and washers—bright cadmium plated.
ELEMENT TIPS: ¾" tubing with end caps.
TURNING RADIUS: 14'.
WEIGHT: 45 lbs.
WIND LOAD, at 80 mph: 60 lbs.
MAXIMUM WIND SURVIVAL: 100 mph
MAST: Mast-to-boom fitting is machined to fit 1½" o.d. mast. 1¼" E.M.T. (measures 1½" o.d.) is readily available at all electrical contractors. (Mast not included.)
FITTINGS: Cast aluminum alloy. Heavy-duty precision machined.
OVER-HEAD BRACE RODS: Included.

SWAN
ELECTRONICS

TB-3 and TB-2

3 ELEMENT MODEL TB-3

Of somewhat lighter construction and shorter boom length, the TB-3 is adequate for many installations. Wind survival rating is 80 mph compared to the 100 mph rating of the TB-3H. Its lighter weight permits easier erection, a lighter weight tower, and lighter duty rotator, all resulting in lower overall cost. The same precision tuned, weather proofed traps are used, so power rating and reliability are the same as in heavier duty models. Boom length is 14 feet. **$84**

SPECIFICATIONS

POWER RATING: 750 watts AM, 1500 watts P.E.P. on single sideband.
RESONANCE:
10 m—28.750
15 m—21.350
20 m—14.250
FRONT-TO-BACK RATIO: 18-20 db, average.
FORWARD GAIN:
8 db average. Note: Antenna gain is quite often a highly exaggerated claim. Generally speaking, actual antenna gain will be directly related to the length of the boom assuming normal antenna efficency. Pound for pound, and foot for foot, the Swan TB-3 will equal or exceed the forward gain of any competitive design.
SWR AT RESONANCE: 1.2 maximum.
TRANSMISSION LINE: Single 52-ohm coaxial cable, Standard PL-259 coaxial connector.
HARDWARE: Bolts, nuts and washers—bright cadmium plated.
OVER-HEAD BRACE RODS: Included.
FREQUENCY-DIVIDERS: **Slim-line, completely enclosed and weather-sealed.
ELEMENTS: Seamless, 6061-T6 aluminum tubing: 1″ tapering to ¾″.
BOOM: 1½″ o.d. x 14′ heavy-wall galvanized steel tubing.
ELEMENT SPACING: 3 elements, spaced 7′ on 14′ boom.
ELEMENT TIPS: ¾″ tubing with end caps.
TURNING RADIUS: 14′11″.
WEIGHT: 37 lbs.
MAST: Mast-to-boom fitting is machined to fit 1½″ o.d. mast. 1¼″ E.M.T. (measures 1½″ o.d.) is readily available at all electrical contractors. (Mast not included.)
FITTINGS: Cast aluminum alloy. Heavy-duty precision machined.

**patented

2 ELEMENT MODEL TB-2

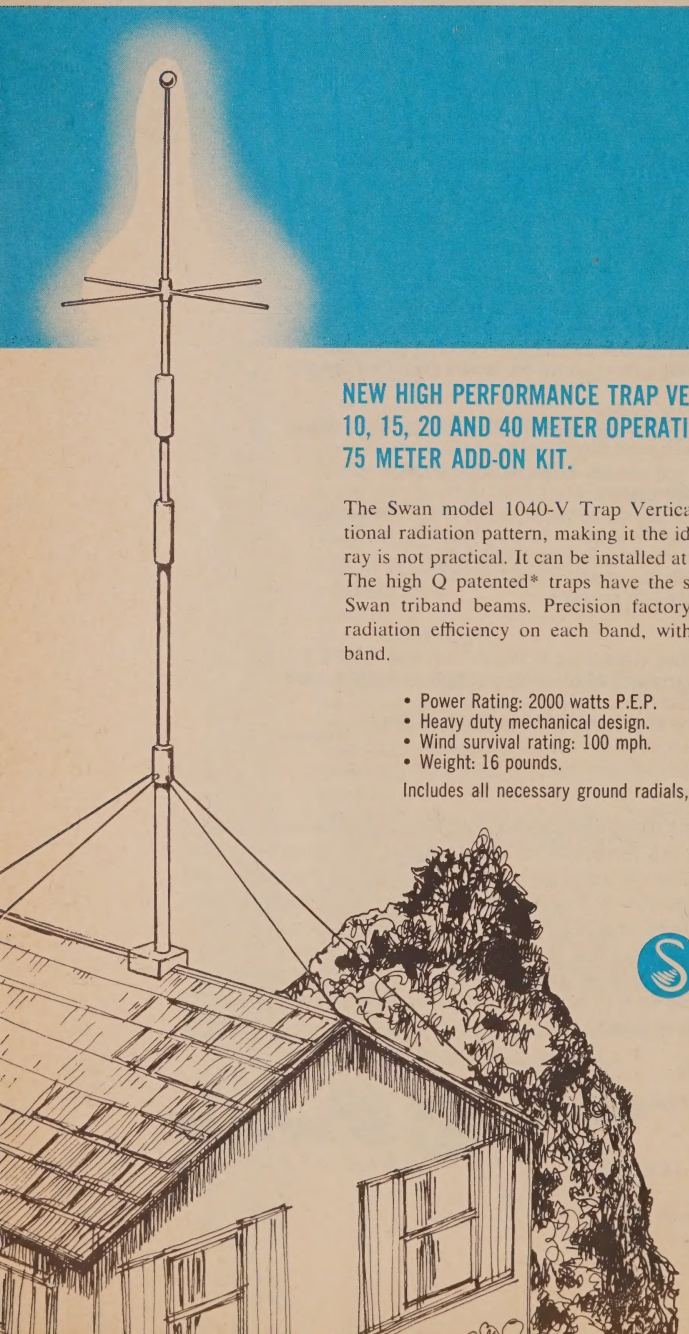
Same design as the TB-3 but with 2 elements on a 6½-foot aluminum boom. Weighing in at only 15 pounds, this model can be a real surprise. An inexpensive telescoping mast and TV rotator will easily get it 60 feet or higher off the ground, and at that height it will out perform a 3 or 4 element beam at lesser height. If your choice is putting up the TB-4H at a 30 to 40 foot height, or this 2 element model at 60 feet, by all means put up the TB-2. We won't make as much money, but you'll put out a terrific signal, and maybe we'll sell more TB-2's. Of course, if you can put the 3 or 4 element model up 60 feet, or more, there's no argument. Just don't under estimate the TB-2. It's a little bomb. **$69**

SPECIFICATIONS

(Same as Model TB-3 except as follows)
TURNING RADIUS: 14′
BOOM LENGTH: 8′.
FRONT-TO-BACK RATIO: 16 to 18 db.
WEIGHT: 15 lbs.
WIND LOAD, at 80 mph: 60 lbs.

SWAN ELECTRONICS

Trap Vertical antenna



NEW HIGH PERFORMANCE TRAP VERTICAL 10, 15, 20 AND 40 METER OPERATION, WITH PROVISION FOR 75 METER ADD-ON KIT.

The Swan model 1040-V Trap Vertical has a low angle, nondirectional radiation pattern, making it the ideal antenna when a larger array is not practical. It can be installed at ground level, or on a rooftop. The high Q patented* traps have the same adjustable design as the Swan triband beams. Precision factory tuning results in maximum radiation efficiency on each band, with low SWR across the entire band.

$49

- Power Rating: 2000 watts P.E.P.
- Heavy duty mechanical design.
- Wind survival rating: 100 mph.
- Weight: 16 pounds.

Includes all necessary ground radials, brackets, and hardware.

*Patent No. 3064257

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5% SALES TAX Calif. Residents	
TOTAL	

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(Swan pays shipping charges, except on C.O.D.)

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(Customer pays charges)

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☐ AIR EXPRESS
☐ OTHER _____

_____

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☐ CHECK
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☐ BANKAMERICARD
_____
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Experimental I.F. Noise Blankers

BY FRANK C. JONES,* W6AJF

THE two experimental i.f. noise blankers shown in figs. 1 and 2 were built on the same 3 × 5 inch copper plated board as a project to try out some ideas. The unit was slipped into an existing tube receiver between the mixer tube and the 455 kc mechanical filter where only a couple of leads had to be cut and spliced out to the nearby circuit board. The internal 105 volt supply was tapped for about 9 ma to a 1/4 watt zener diode regulator for the transistor amplifiers in the blanker circuit board. The VR tube regulator could in this case supply the extra current without extinguishing.

Mosfet transistors (40468A's at 75 cents each) were used in the i.f. circuits since they were relatively inexpensive and require no neutralization at 455 kc. Enough gain could be had with less than 2 ma per transistor as set by small potentiometers mounted on the board. For a permanent installation a small amount of negative a.g.c. voltage could be taken from the tube receiver through a 5 megohm potentiometer so the units would be fully automatic in operation for fading signals, once the other bias voltages were adjusted for optimum noise blanking. The other bias voltages were adjusted for optimum noise blanking. The units described here were only a few of several noise blankers used in tests here over a fairly long period of time. The ignition and "power" noises are very annoying on two and six meters at this location. The search has been for a "perfect" noise blanker so each new idea means another blanker being built for test. Needless to say, none are perfect, and the search goes forward. Some units work fine for ignition suppression but tend to blank out desired signals when local stations slightly off the desired signal frequency cause the blanker to operate. Too much selectivity ahead of a blanker

*850 Donner Ave., Sonoma, Calif. 95476.

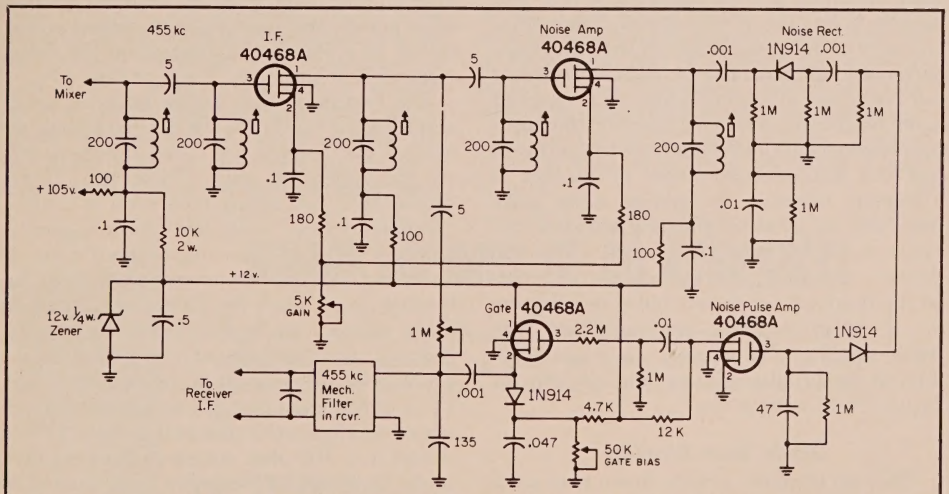


Fig. 1—I.f. noise blanker with diode gating. This circuit provides about 40 db of attenuation of noise pulses. All capacitor values greater than one are in mmf; those less than one are in mf unless otherwise indicated. All resistors are 1/2 watt unless otherwise indicated.

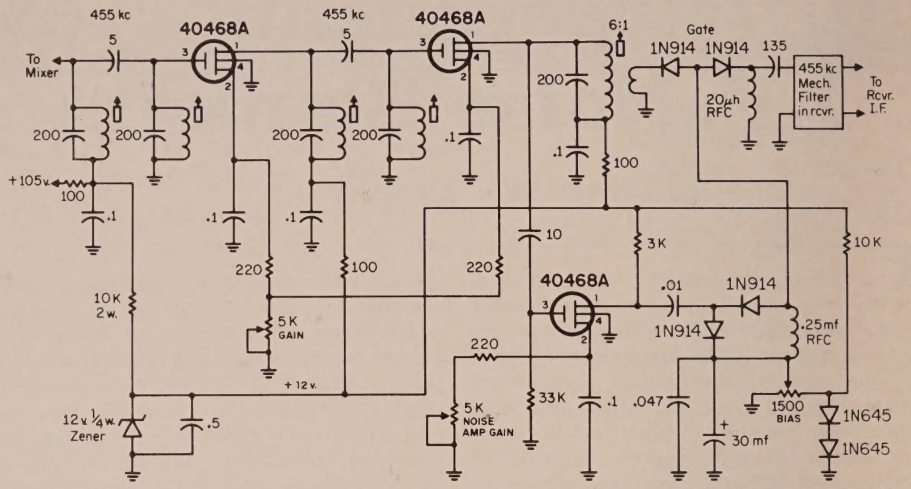


Fig. 2—Improved i.f. noise blanker using an RCA 40468A Mosfet gate. This blanker provides good noise blanking ahead of the receiver's mechanical filter which minimizes pulse broadening. Initial adjustments are more critical than with the circuit of fig. 1. Capacitors greater than one are in mmf unless otherwise indicated; those less than one are in mf. Resistors are 1/2 w. unless otherwise noted.

will cause noise pulse lengthening and some loss. Too little selectivity usually causes total loss of desired signal due to the action of adjacent frequency signals.

The circuits shown were an attempt to compromise on this problem. Five small Japanese single circuit i.f. transformers were used, loaded to a *Q* of about 20 or less, and seemed to be okay in this circuit. Some noise blankers built for use between the v.h.f. converters and the turntable i.f. receiver, *blanked out everytime* a mountain-top v.h.f. repeater came on the air within 50 miles of this location. Some locations do not have this problem and this non-selectivity type of blanker is extremely effective on ignition noise since there are no pulse lengthening selective circuits to worry about. Several a.f. noise limiters are quite effective on broad bandwidth receivers where no pulse lengthening is a problem, but then one can't hear very weak signals without good i.f. selectivity—and so the problems go on and on into the future. Nothing is perfect.

Diode Gate Blanker

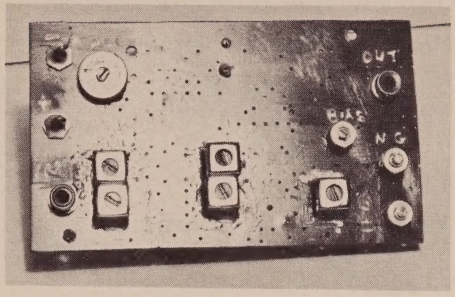
The two blanker circuits shown here work reasonably well in a "rough" location. The unit in fig. 1 (and in the photographs) was built first. It has two more or less standard i.f. stages at 455 kc, with adjustable gain which drive a noise amplifier as well as a couple of back to back fast diodes on a noise gate. The noise amplifier of low gain has to be biased high enough to let the desired signal get through the gate (to speak of anyway). A hole in the signal results but enough signal gets through during the intervals between ignition noise pulses, and some types of ragged power noises, so a person can understand the signal whether it is a.m., f.m., s.s.b. or c.w.

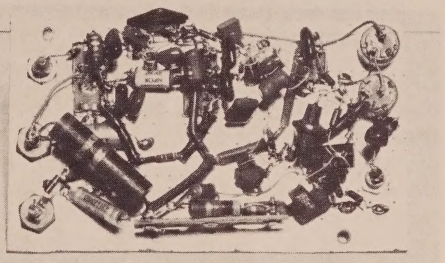
The two noise gate diodes being in series and forward biased for the desired signals do cause a great signal loss, needed here to offset the added i.f. gain. These two diodes should be a fast acting type such as 1N914 computer diodes with low shunt capacity. Some diodes have too much shunt capacitance and this passes noise pulses right on through even when the diodes are supposed to be blanked by high negative d.c. pulses. A lower shunt capacity of 1 to 2 mmf means pretty good attenuation in this respect at 455 kc. It was thought that this noise pass-through would be attenuated about 60 db with 1N914 diodes in a 500 ohm circuit of the type used in fig. 1. However, listening tests seemed to only indicate about 40 db attenuation of the noise pulses. This amount is very useful, but more is desirable.

The circuit in fig. 2, tried out later on the same copper plated board and i.f. system, works on a different principle. There is less added i.f. gain for the signal and a one megohm variable resistor offsets this gain into the mechanical filter. It also permits the blanker circuit to shunt the noise pulses down to very low values which get into the selective filter. The two paths for noise pulses, one a.c. and the other d.c., have to be balanced for good operation. This is difficult, but can be done by careful adjustments. The results are good noise blanking ahead of the mechanical filter at the expense of more careful preliminary adjustments. In actual use a small negative a.g.c. or a.v.c. voltage is needed on the two i.f. stages as described for the circuit of fig. 1.

In fig. 2, the second i.f. stage is needed to build up a good noise pulse voltage to actuate the 1N914 noise rectifiers. The resistor and capacity values in the noise rectifier are chosen to select the sharp noise pulses in preference to the signal voltage. The d.c. noise pulses are amplified by a pulse amplifier and then converted to a.c. noise pulses into the gate of a source follower stage. The latter is needed to change from a high impedance system to low impedance for shunting out the input to the mechanical filter. Here the input to the filter is parallel resonant and a fairly high impedance at signal frequencies as contrasted to series resonance and low driving impedance in the circuit of fig. 1.

The 40468A source follower is normally "open circuited" for conditions of no noise pulses. A 50,000 ohm potentiometer sets the level of noise blanking. This adjustment of about 11 volts down to zero volts gives back bias to a 1N914 diode and practically opens up the source circuit which shunts the mechanical filter. A fast computer diode is needed in this circuit to follow the steep wave

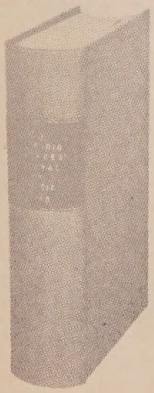




Top and bottom view photos of the diode gate noise blanker of fig. 1 built on a 3" x 5" piece of copper-clad board in an experimental manner. The photos emphasize that parts layout is relatively uncritical with the exception of separating input and output circuitry.

forms of a noise pulse voltage. Needless to say, all three potentiometers have to be optimized in their settings for best noise blanking.

It seemed to the writer that this noise blanker (fig. 2) was a little better than that of fig. 1 in his particular communications receiver which was a homemade set. The 500 to 1000 dollar cost of a good receiver always makes a good homemade receiver at a fraction of this cost (with surplus parts) look very good to the writer. Besides that, I enjoy building even more than operating a good receiver. ■



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CQ Reviews: The LEL Dynamic Serviset Model E-C

BY WILFRED M. SCHERER,* W2AEF

ONE of the latest pieces of test gear we've run across is the Lee Electronic Labs, Inc. Dynamic Serviset Model E-C. It is a low-cost, light-weight, portable, versatile and compact job designed for trouble shooting electronic gear. It combines many test functions into one package, eliminating the need for several separate pieces of test gear to cover a variety of applications. As such, it may serve as a convenient diagnostic tool for servicing equipment such as receivers, transmitters, a.f. amplifiers, TV sets and other gear in the amateur, commercial and TV field.

One of its functions is that of r.f. and a.f. signal tracing which enables equipment failures to be localized, a necessity we've often pointed out in the Q & A Column or in written replies to related queries.

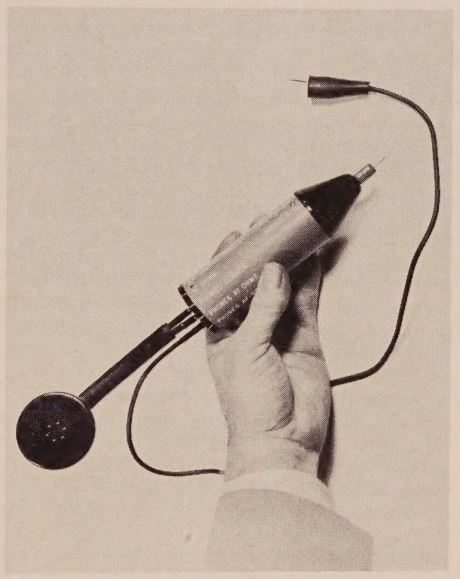
Other applications for the Serviset are: a.f. signal injection; determining the presence of a.c. and d.c. potentials of 0 to 60, 550, and 20,000 v.; d.c. polarity indicator over same ranges; low-ohms continuity and short indicator; high-ohms continuity and leakage checker; substitution and test for low- or high-value capacitors including electrolytics and for low- medium- and high value resistors; dynamic checking of speakers or phones for continuity and acoustic coupling; testing low- medium- and high-power transistors for shorts, opens, leakage, gain and determining PNP or NPN types; as an emergency flash-light.

Construction

The Serviset is built into a $1\frac{3}{4}$" diameter probe unit made of high-impact material. It is $5\frac{3}{4}$" in length and is tapered to a tip at one end where the contact probe is located. It takes on the appearance of a satellite-launching rocket.

At the rear end are 13 phone-tip jacks arranged in a circle along the perimeter. The probe circuitry is a combination of various type test circuits where each one of the jacks is connected to the proper point required for the particular function. Identification of the function of each jack is marked on the barrel of the Serviset opposite the related jack. No switches are involved.

The "common" or "low-side" of the test circuit is usually plugged into one of the jacks. Two leads are supplied according to the various needs. One lead is 30" long and is equipped with a medium-size alligator clip. The other test lead is a 10" one equipped with a miniature-size clip. A single headphone is used for many of the tests and is mounted



The LEL Dynamic Serviset Model E-C. The "common" test lead at the left is plugged into one of the phone-tip jacks probided for the various functions. The prefocused lamp is at the center of the ring of jacks. The neon lamp is behind the hole in the side of the barrel. The plug-in headphone is at the left.

*Technical Director, *CQ*.

on the end of a 4" rigid support that plugs into the phone-tip jacks on the unit. A 30" extension cable for the headphone also is supplied. In addition, two prod-tip extensions are furnished for easy access in tight quarters. One of these is an insulated Klipzon-type extension, the other is a TV high-voltage adapter.

Behind a hole at the side of the probe barrel is a neon lamp used for some functions. A prefocused lamp is at the center of the rear end of the unit and may be used as a flashlight in dark areas of equipment. Power required for some functions is supplied by a self-contained pen-lite cell; no external power is required.

A high-quality fabric carrying pouch is furnished with individual compartments for storing the Serviset and all accessories including the instruction manual. The latter contains specific details for each function and it includes a transistor trouble-shooting section.

Applications

R.F. Signal Tracing: This application of the Serviset is used to determine at which stage or point the defective equipment is not functioning properly. With a modulated signal (from a signal generator or an on-the-air signal) applied to a receiver, the Serviset probe is moved along from stage to stage (grid, plate, base, collector, etc.), until the point is found where there is a loss of signal or expected gain as indicated by the absence or relative level of the signal modulation heard in the Serviset headphone. Trouble can thus be localized to a specific area as long as the preceding stage is indicated to be functioning as determined with the instrument.

With a strong fully-modulated signal applied to a receiver, the r.f. signal-tracing sensitivity in most cases was found to be adequate for use at the r.f. stage output and on through the rest of the receiver stages up to the detector input. This application is not limited to radio receivers only, but also may be employed on TV sets.

We've run across many cases in our own experience and in the Q & A mailbag where trouble has been encountered with s.s.b. exciters where low output or a gradual dropoff in output is experienced on one or more bands. Where this is due to trouble in a stage other than at the p.a. output, r.f. signal tracing with the Serviset here will aid in localizing the problem. An a.f. input to the transmitter is required for these tests and may be obtained by feeding the mic input with a low-level signal from an a.f. oscillator, radio receiver or tape playback.

A.F. Signal Tracing: This function is conducted in a manner similar to that employed with r.f. signal tracing, except it is used on a.f. stages such as found in a radio receiver, transmitter, a.f. amplifier, TV set, etc.

Capacitance Substitution: This application provides a substitute capacitor where low values (.01-1 mf) are required, such as for coupling, by-pass, blocking, etc. elements. There is another range for substitution of high-value electrolytic filter and bypass units (4-40 mf). Defective capacitors or the need for the addition or a change may thus be determined. For these tests the Serviset is connected across the suspected capacitor or to the specific points of interest. This function also may be used to bypass a defective r.f., i.f. or a.f. stage.

Resistor Substitution: This function provides a substitute resistor for low values (approx. 50-500 ohms up to 2 watts), such as used for cathode bias, low-power filters, etc. Defective filter chokes also may be located therewith. A second substitution range is available for medium-value resistors (5K-25K up to 1 watt), such as used for dropping, decoupling, plate load, etc.; while a third range provides substitution for high values (approx. 100K-1 meg. up to 1 watt), such as used for grid or plate load, a.g.c., etc.

With the Serviset connected across the suspected element, an open or otherwise defective resistor (or capacitor in the preceding application) may be determined by noting if the equipment is restored to normal operation at this time.

A.C.-D.C. Voltage and Polarity Indicator: This function is useful over a range of approx. 60-550 volts. With the Serviset connected across the voltage source, both electrodes in the neon lamp will glow if the source is a.c. On d.c., only one electrode will glow, in which case a glow in the lower electrode indicates a positive polarity at the probe tip. It is negative when only the upper electrode glows.

A.C. and D.C. Voltage Levels: Useful over a range of 0-60 volts. With the Serviset connected across an a.c. voltage source and using the a.f. signal-tracing function, the relative amplitude of 60-cycle hum heard in the headphone indicates the approximate a.c. voltage level.

D.C. voltages are similarly checked, except the approximate d.c. level is indicated by the relative amplitude of a cleck heard in the headphone as the prod tip is touched to or released at the voltage point.

Low-Ohms Continuity and Short Checking: This function is useful over about a 0-5 ohm range. When the Serviset is connected across the suspected element or circuit, continuity is indicated by the prefocused lamp which then lights. Normal lamp brilliance indicates a short or continuity over a circuit lead; while the relative degree of lower brillance indicates circuit resistance.

High-Ohms Continuity and Leakage Checking: Useful over a 0-500K range. This is con-

ducted in a similar manner as for low ohms, except continuity is indicated by a click in the headphone when the probe tip makes or breaks contact at the circuit. Low or high resistance is indicated by the relative amplitude of the click.

Leakage and Short Testing of Coupling Capacitors in R-C Amplifiers: For this use the Serviset is connected between the ground or chassis side of the circuit and the grid side of the coupling capacitor. An intermittent or bright steady glow in the neon lamp indicates a leaky or shorted capacitor.

Leakage and Continuity Checking of Other Capacitors and High-Value Resistors Up To 20 Meg.: For this application the high-value capacitor in the Serviset is first charged up by momentarily placing it across a d.c. source of 100-450 volts. The unit is then connected across the suspected component. If this is a capacitor, the neon lamp will brightly glow should the component be shorted; will weakly flash continuously if the capacitor is leaky; or will produce a single flash if the capacitor is good without leakage.

A.F. Signal Injection: This function supplies an audio signal for checking a.f. amplifiers. This is done by connecting the Serviset to the amplifier input and speaking into the headphone which then serves as a microphone.

Conclusion

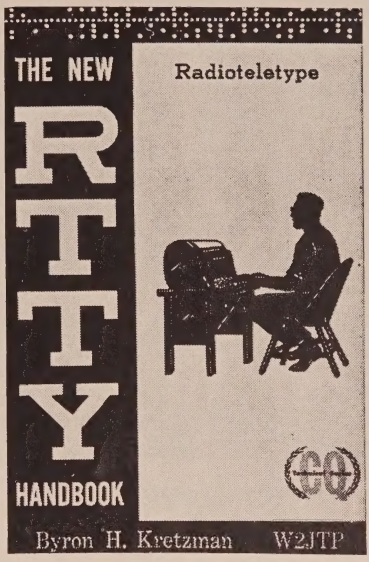
The foregoing applications represent the major uses for the instrument and provide an indication of its basic principles of operation. Besides other applications set forth in the manual, (including an extensive number of tests on TV receivers from the front-end right through the oscillators, sync, sound and video chains plus power supply) additional uses and techniques will suggest themselves as the operator becomes familiar with the device.

As may be noted, the results of some of the tests rely only on the relative amplitude of sound in the headphone, that of a click or the brilliance of a lamp and thus do not provide absolute values such as may be obtained with a v.o.m., etc. However, the relative indications essentially provide a go-no-go determination without the need for test equipment other than the Serviset itself for a wide variety of tests. It therefore serves as a single and handy all-around piece of test equipment, particularly for field use. An extra feature is that the case of the unit is completely isolated from the test circuit.

Evidently instruments similar to this model of the Serviset have been found useful to at

[*Continued on page 116*]

"THE NEW RTTY HANDBOOK"



A treasury of vital and "hard to get" information. Loaded with equipment schematics, adjustment procedures, operating procedures, etc. A valuable asset to both the beginning and the experienced RTTY'er. Special section on getting started, all written by Byron Kretzman, W2JTP, a well known authority in the field. This book is a must for your library! Only $3.95.

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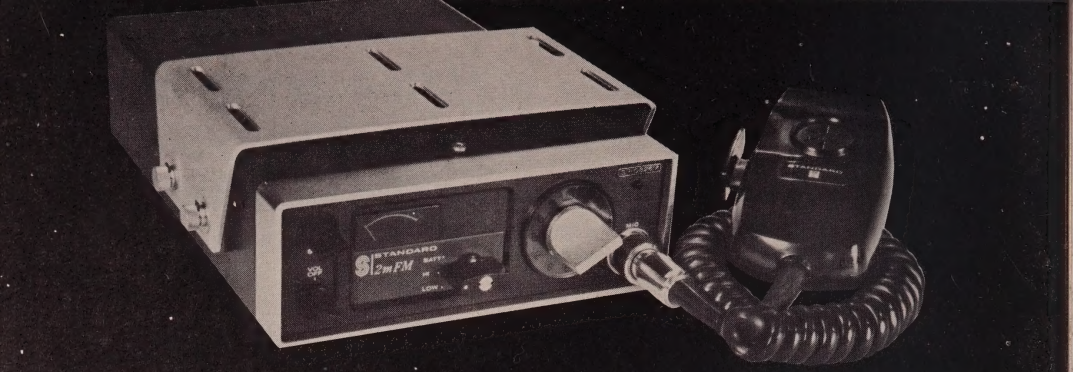
SIRS: My check (money order) for $_____ is enclosed. Please send _____ copies of the "The New RTTY Handbook.

Name_____

Address_____

City_____ State_____ Zip_____



New FM for '71 Standard's SR-C826M

professional quality, solid state, two-way radio, designed and sold exclusively for amateur use in the United States and Canada.

Standard Communications Corp., the world's largest manufacturer of marine V.H.F. equipment, has just developed a new industrial quality, high performance 2-meter unit. This rugged, compact transceiver is available only in the U.S. and Canada thru an authorized Standard dealer. The "826" is so compact that it makes mobile installation practical in almost any vehicle or aircraft, it becomes fully portable with the addition of Standard's battery pack.

GENERAL

Freq. Range — 143 to 149 MHz, 2 MHz spread

Supply voltage — 11 to 16 VDC. Negative Ground 13.8VDC nominal

Current Consumption — .15 amp receive standby. 2.4 amp transmit

Number of channels — 12- Supplied with 4 channels

1) 146.94 Simplex
2) 146.34/94
3) 146.76 Simplex
4) 146.34/76

Microphone — Dynamic

Dimensions — 6⅞"w x 2½"h x 9⅞"d

Weight — 4½ lbs. max.

Frequency stability—.001% (−10 to +60°C)

TRANSMITTER

RF power output — .8 or 10 watts

Output impedance — 50 ohms nominal

Deviation — Internally adjustable to ±10 kHz min. factory set to ±7 kHz

Spurious and harmonic attenuation — 50dB below the carrier power level

Type of modulator — Phase

RECEIVER

Sensitivity — .4 or less microvolts for 20 dB quieting

Squelch sensitivity — Threshold — .2 microvolts or less

2 MOSFET RF Amplifiers
1 MOSFET Mixer

Deviation acceptance — Up to ±15 kHz deviation

Spurious and image attenuation — 65 dB below the desired signal threshold sensitivity

Adjacent channel selectivity (30 kHz channels) — 60 dB attenuation of adjacent channel

Type of receiver — Dual conversion superheterodyne

Audio output — 5 watts For external speaker

$339.95 (complete as shown with microphone, built-in speaker and external alternator whine filter.)

STANDARD COMMUNICATIONS CORP.
World's largest manufacturer of marine V.H.F. equipment
P.O. Box 325, Wilmington, Calif. 90744 (213) 775-6284

F.M.

BY GLEN E. ZOOK,* K9STH/5

SOME of the things which a new columnist learns to live with are deadlines and lead times. Because of these necessities in the publishing world this column is being written at the same time as the first column is being distributed. Thus, reader participation is still at a minimum. However, I promise to include information and applicable suggestions just as soon as they are received (hopefully in the April column. Since the information from active amateur f.m'ers is still scarce, I shall take this opportunity to editoralize a little.

Amateur f.m. activity in most parts of the United States and Canada appears to be a hybrid between usual amateur techniques and commercial techniques with a little CB thrown in for good measure. Each locale has its own accepted practices and techniques. Some repeater groups use the "10" signals regularly, while other groups use the Q signals of normal amateur operation. Even other groups frown on either type of signal and use only plain language. No matter what type of operation practice is used, it is best for the newcomer to observe the practice and techniques of others before venturing into the picture. There are however, several practices which seem to be creeping into amateur f.m. operations which, when imitated by newcomers soon snowball into a chaotic situation. The operating practices which I am going to describe may seem insignificant when observed in the singular. However, when they are repeated over and over they begin to look different even to the newest f.m.'er. What are they? Well, the first thing is the practice of calling the same station over and over during a short period of time. Since f.m. operation is normally a channel type with fixed-frequency receivers and transmitters the station called will receive the call the first time if he is in a position to hear any call, (especially through repeaters). Subsequent calls only serve to tie up the freqency and annoy those operators who monitor the frequency for public service, emergency calls, etc. This is not to say that rag chewing is not appreciated, only that repeated calls to a station who is not answering is uncalled for. Space your calls to allow someone else a chance to make a call and to allow time for the station being called to turn on his equipment, come home, or some similar situation.

*818 Brentwood Lane, Richardson, Texas 75080.

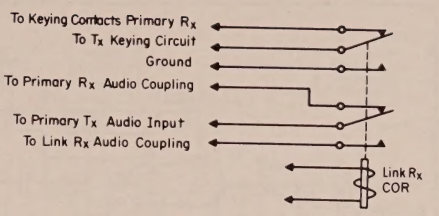

To Keying Contacts Primary Rx
To Tx Keying Circuit
Ground
To Primary Rx Audio Coupling
To Primary Tx Audio Input
To Link Rx Audio Coupling
Link Rx COR

Fig. 1—Link receiver control logic.

A second practice which results in the unnecessary and annoying use of an f.m. frequency is this business of clearing. Commercial regulations (including Class D CB) require that a station clear the frequency each time he is through (certain public safety services are excepted). This clearing must take place whether or not a contact is made. Amateur operation does not require this clearing. After a QSO it is not only proper but courteous to clear the frequency to let others on the frequency know that you are through with the channel. However, the practice of clearing after every call which does not result in a contact is only wasted time and annoyed fellow f.m'ers. If the station called does not come back the other

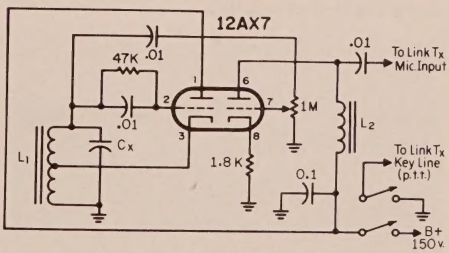


Fig. 2—A tone encoder.
Cx—To resonate at desired freq.
L_1—88 mh telephone loading coil.
L_2—Audio choke. Primary of 50L6 output transformer suitable.

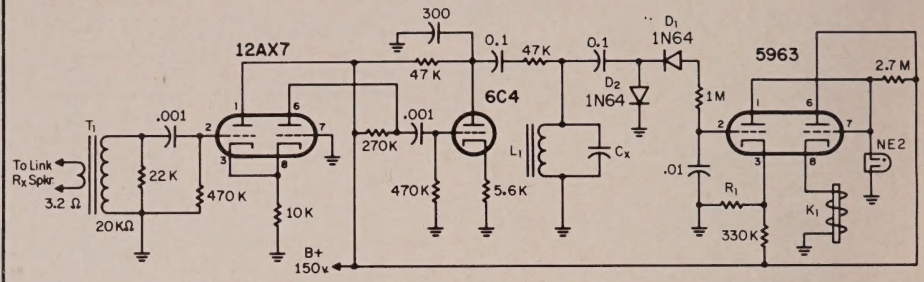


Fig. 3—A modified Twin City TU decoder.

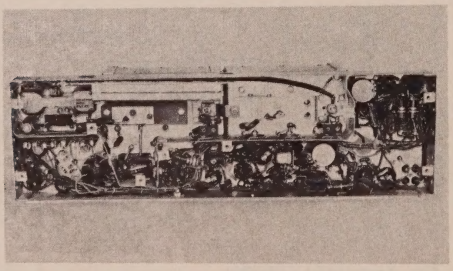
Cx—To resonate at desired freq.
K_1—Plate current relay. 8000 ohm coil.
L_1—88 mh telephone loading coil.
R_1—0-10 K. Vary for best results.
T_1—Output transformer. 20 K. primary to 3.2 ohm sec.

stations on the channel (or repeater) will know it. Comments like "No station heard, WB5XXX clear" and "WB5XXX clear after negative contact" serve no useful purpose. Think back to your operation on the d.c. bands (80 through 10 to the non v.h.f'er). Would not a station calling CQ who received no answer sound funny if he came back and said "no station heard, WB5XXX clear" or some similar statement. Think about it.

Well, that enough opinion for one month. Last month I promised to continue with the description of the basic repeater, so here it is:

Technical Talk

The basic repeater described last month is just that, basic. The only control functions provided were transmit-receive and audio over-ride via two wire line in addition to the normal repeater function. This month's addition is to keep the FCC happy when a two wire line is either not available or not desired. Also, automatic shut-down protection is added.



Underside view of the Motorola 450 mc "A" transmitter. Note the flat cavities near the top center. Older type units have a long cylindrical cavity.

The present amateur regulations require supervisory control of any remote operated amateur transmitter by either wire line or by a radio control link above 220 mc. Such u.h.f. equipment is now readily available in the 3/4 meter (420 to 450 mc) because of the implementation of new technical standards. These new standards have rendered many units now used in the 450-470 mc commercial band useless for commercial operations. However, these narrowband standards are not required for amateur usage. Thus, many repeaters now employ such obsolete u.h.f. f.m. equipment for control links. The unit described for use in the basic repeater is the Motorola "A" type of equipment. This equipment is reaily available from numerous sources in the form of T44AAV, L44AAB, and similar units. Again, u.h.f. equipment manufactured by other companies is also suitable. Power connections and other items will have to be altered, but the principle remains the same.

The addition of a control link is really the addition of a second input frequency (and, if desired a second output frequency) to the repeater. The logic is wired to provide audio over-ride of the signal on the primary input frequency and to provide a means to disable the repeater's primary transmitter if so desired. This disable (and reset) function is provided by selective tone signaling. The circuits described later are neither new nor unique. They employ relays and tubes, along with other readily available parts. Solid-state circuitry is fine, even better in some cases, but the present chore is to build a good, working repeater. Refinements can come later, and they include solid-state circuitry.

As stated before the control link transmitter and receiver in the described repeater are Motorola. The u.h.f. "A" receiver is of two types. One type uses an active (r.f. amplification tubes)

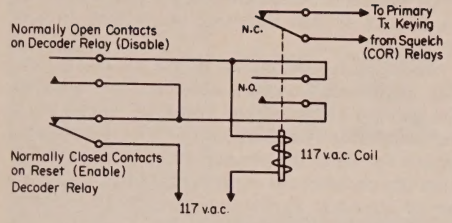


Fig. 4—Disable-enable relay logic.

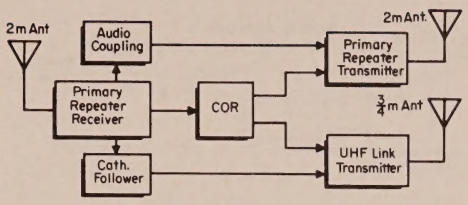
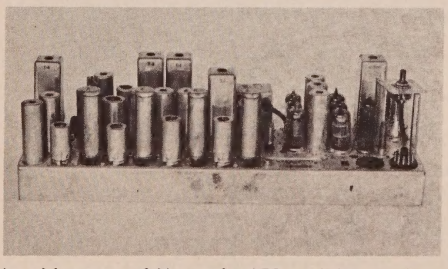


Fig. 5—Link transmitter logic.

"front-end" and the other type uses a passive (signal through cavities to the mixer with no amplification) front-end. The passive front-end is newer, but both receivers have basically the same specifications. If a choice is available, I prefer the passive front-end. The photographs are provided as an aid in identifying the receiver types. The transmitter is rated at 18 watts output and employs a 2C39 driven by a 2C39. Again there are two types of transmitter. The older type employs a fixed-tuned harmonic filter which resembles a long section of pipe on the under side of the chassis. The newer type employs two flat tunable cavities on the under side of the chassis. Also, the boxes enclosing the 2C39's on the older types are often copper plated, and the boxes enclosing the tubes on the newer types silver plated. This is usual, but not mandatory. Tune-up instructions are quite lengthy (especially for the receiver) and will not be repeated herein. Such instructions for tune-up are available in the *Motorola FM Schematic Digest,* published and sold by S. Wolf, Two-way Radio Engineers, 1100 Tremont Street, Boston, Mass. 02120. Price is $6.50 postpaid. Power may be obtained from the Motorola TU112 power supply or a similar home-brew or other manufactured model.

The radio link operating in the 450 mc amateur band operates just like the basic repeater. The link receiver can turn on the primary repeater transmitter, voice can be transmitted through the repeater and out on the primary transmitter, and with the application of the correct tone the primary transmitter can either be enabled or disabled. As in the basic repeater the audio coupling from the link receiver can be coupled to the primary transmitter either through the Motorola P8066 series remote panel or through a cathode follower circuit (see last month's column for circuits). In either case the audio from the primary repeater receiver must be interrupted, as must be the keying circuit. The logic for accomplishing this appears as figure 1. In this circuit the squelch relay (again see last month's column for squelch relay or COR circuit) on the link receiver opens both the key line from the primary receiver and the audio line to the transmitter. In its place the link receiver COR keys the primary transmitter and couples the audio from the link receiver to the primary transmitter, thus giving control to the link receiver. If it is desired to disable the primary repeater transmitter a tone can be sent to the link receiver which in turn operates a relay to open the key line to the transmitter. This relay remains energized until a second tone (another frequency) is transmitted to the link receiver. This tone then energizes a second relay which releases the first relay and restores the key line. The second tone must be transmitted for about five seconds to allow the first relay to drop. Of course a single tone and a stepping relay could be used, but this requires more expense and does not insure as positive control as the two tone system. The choice of tone frequencies is delegated to the repeater organization. Just remember, regulations set a 3000 c.p.s. tone as maximum. The encoder and decoder circuits are taken from the *New RTTY Handbook* published by *CQ,* with minor modifications. The encoder circuit is figure 2, the decoder circuit figure 3, and the relay logic is figure 4.

If a 450 mc link transmitter from the repeater to the control point is used (usually a receiver tuned to the repeater primary output frequency is sufficient), it can be connected similar to the primary transmitter. In this case, use the cathode follower type of audio coupling to reduce interaction of the two transmitter audio circuits. Also, a second set of keying contacts to the COR on the primary receiver. The simplified logic appears as figure 5. And, as a final note, make sure that the u.h.f. transmitter is on a different frequency than the link receiver (preferable 5 mc or more away). This is to make sure that control



An older type of Motorola 450 mc "A" receiver. The newer types have flat cavities and no tubes in the front ends.

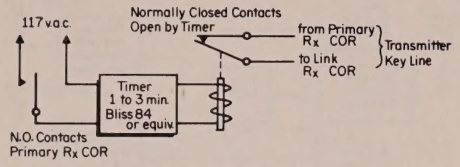


Fig. 6—Timer logic.

of the repeater can still be maintained by the link receiver-tone control system.

A time-out timer is a necessity on amateur f.m. repeaters. This prevents the unnecessary tying up of the channel in case of either repeater malfunction or continuous carrier on the input frequency. Also, such a timer discourages long-winded transmissions. The circuit for the time-out timer appears as figure 6.

The implementation of a control link and time-out timer just about completes the simple repeater. Next month's Technical Talk will add an identifier (again to keep FCC happy) and make some suggestions for meeting logging requirements.

Q & A

Q. I am having difficulty obtaining 2C39 tubes for my u.h.f. f.m. gear. Is there a suitable substitute?

A. Yes. The 3CX-100A5 and 7289 are both suitable substitutes. The 3CX100A5 is the better of the two and is quite often substituted for the 2C39 in commercial applications. One bonus is that the 3CX100A5 is often cheaper than the 2C39 and lasts longer.

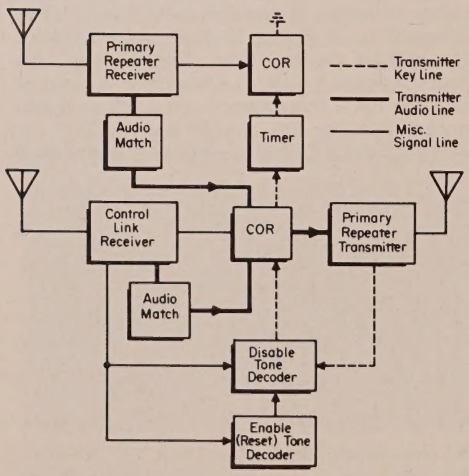


Fig. 7—Repeater functional diagram.

Q. Which is better, obsolete commercial f.m. equipment or that imported equipment already on amateur f.m.?

A. Boy, are you trying to put me on a spot. The equipment now manufactured for amateur f.m. is both imported and domestic. Such equipment is presently either completely solid-state or almost so. Thus, the physical size is often smaller than the commercial equipment. Also, the number of channels available is also greater on the equipment built for amateur only use. On the other hand, the obsolete commercial equipment often runs a higher power output. Also, the prices on the obsolete commercial equipment are often much lower than the units built for amateur use only. In addition, the commercial units were built to take all kinds of punishment and are usually able to take much more. Thus, the decision as to which general type of equipment is better must be made by the amateur interested in purchasing the equipment.

Q. I just ran across a Comco 278-E-6/12/24 unit. It is very clean and has all accessories with it. On what f.m. frequencies can I use the unit?

A. Sorry, this unit was designed for ground equipment working with aircraft in the 108-132 mc band. The unit is a.m. only with one or two crystal controlled channels. It makes a fine receiver for listening to your local airport control tower, but is useless for amateur f.m. Try Fc-10.7 mc (where Fc is desired reception frequency) for a receive crystal.

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Finale

My little tirade at the beginning and the diagrams to go along with the repeater just about take up the available space, so no space is left for the news which has not yet come in. Some logic. Anyway, if you have not yet sent in a suggestion, comment, criticism, or praise, send in one. If you have already sent something, send more. This column is for you, the active F.M'er.

"If they find you this time I'll eat your helmet."

DX

BY JOHN A. ATTAWAY,* K4IIF

If you live in the deep south the first touches of spring are here; budding trees, green grass, and daffodils. In the mid-section the south winds aren't far away. NOW, not January 1, is the true time of rebirth and new resolutions. Lets make 1971 the year of courtesy on the ham bands.

Over the past few months we have heard more complaints of bad manners over the air than ever before. People are becoming concerned, and rightly so. The following excerpts from a letter by Lowell, W2CNQ, on the subject of deliberate QRM, are very appropriate:

"We are not at war on the ham bands. Every man has rights, but when he imposes on the rights of others he is over-extending himself. If one doesn't agree with a net, a DX list, or other activity on the air that's OK, but it doesn't give one the right to QRM such activity. If you wish to take issue with a situation please do so in a legitimate and gentlemanly manner such as a petition to FCC to change the rules, publishing your views, or having a person-to-person discussion with those with whom you disagree."

Lowell expresses it well. Deliberate interference to another station is very, very illegal, and in practically all cases involves childish, impulsive action. People following this practice realize this because they never sign their calls. If they really felt they were in the right they would be proud to identify themselves.

De Extra

In the QSL Information section of our December, 1970 column we indicated that cards sent to BY1PK in Peking were being returned with the marking: "Nom du pays destinataire. Errone. Retour." The following letter from Bob, K2EUH, provides an explanation for De Extra readers:

"In regard to the BY1PK item, I might point out the mistake that was made. The marking means that the name of the country to which the card was destined is erroneous. Return to sender.

"Mail to Peking must be addressed to the 'People's Republic of China' and the postal authorities return items addressed to 'China,' 'Mainland China,' 'Red China' or any other form of writing the name of the country as it might ordinarily be known in the West. In the case of Pyongyang, I don't know if they are as rigid on this point or not. I don't believe there is any amateur activity from the country we commonly call 'North Korea' here in the West. However, there is a great deal of short-wave broadcasting from there and reports of reception of s.w. BC stations usually get through. I believe in this case that the SWL's generally are cognizant of the desirability of addressing the reports to the 'Democratic People's Republic of Korea.' If there should ever be any ham activity from there, this would hold true for the QSL's.

"I suspect the postal authorities might let through those letters addressed to the state-run broadcasters, even if not addressed the way they would like, in exchange for the propaganda advantage. Meanwhile knowing that this advantage would not hold in the case of the hams.

"Similarly, mail addressed to 5A-land must now be addressed to the 'Libyan Arab Republic' thanks to the austere military government which took over there a year ago. I understand they are returning all mail not so addressed.

Mary Ann Crider, WA3HUP, latest winner of the QSL Manager of the Month Award, and OM Charles, W3GE. Mary Ann handles the cards for 13 stations including CT1OF, CT1LN, CT2AA, CT2AP, CR6GA and Father Dave—CEØAE. She is also well known as the first winner of CQ's WPNX Award.

*P.O. Box 205, Winter Haven, Fl. 33880.

Lee Wical, KH6BZF, one of the top DXers of the 50th state.

"There may be other such cases although I don't know of any just now. Generally it seems that the far-left ones are most touchy about this."

QRP News

The Milliwatt is now maintaining a QRPp DXCC listing. K4OCE is presently in first place with 118 countries using 7 watts. W9IIL reports 38 countries with 5 watts, EA2CH has worked 37 countries with 1/2 watt, and WAØAVB has 21 countries with only 100 milliwatts. Anyone wishing to be listed should send his reports to *Milliwatt Editor* Adrian Weiss, K8EEG/Ø, Meckling, S.D. 57044.

W1AGS reports 23 zones and 51 countries in 6 hours operation during the contest on Nov. 28. Mac was running 150 watts to a vertical and got everything he called. He says no more kilowatts and expensive beams for him. His friend K2BG now has 46 states and 12 European countries with his PM3A (5 watts).

WNØBEK has logged 17 states in 12 weeks since abandoning his "high power" 25 watt rig for a PM-1 (2 watts).

CQ is considering the idea of a QRPp column devoted to news from "flea power" operators. Let us know if you are interested.

The S.S.B. DX Award Program

200 Countries

212.....K4RTA

Application blanks and complete rules for the new *CQ* S.S.B. DX Award and *CQ* C.W. DX Award may be obtained from the Award Manager, P.O. Box 1271, Covina, CA 91722. The rules may also be found on page 58 of the January issue of *CQ*.

WPX HONOR ROLL

The WPX Honor Roll is based on confirmed current prefixes which are submitted by separate application in strict conformance with the CQ WPX Master Prefix List. Scores are based on the current prefix total regardless of an operators all-time prefix count.

MIXED

W4OPM	Joe Hiller	1050
W9WHM	John R. Leary	811
W8LY	Michael A. Bakos	785
K1SHN	Chuck Banta	746
KØBLT	Frank Cahoy	733
W3PVZ	Joseph M. Olnick	730
W8ROC	Frederick Riecks	729
G3DO	D.A.G. Edwards	721
WØAUB	Bill Bergmann	719
VE3GCO	Garry V. Hammond	713
W4IC	George A. Mack	707
WA5LOB	James Edwards	699
I1SF	Serafino Franchi	690
W4BQY	G.B. Fisher	662
CT1LN	Paulo J. S. Chelho Vieira	652
WA6EPQ	Larry Brockman	617
YU1AG	Djura Borosic	614
W8KSR	Jon Hodgin	609
W4CRW	Robert Sommer	604
W8GMK	John Marhefka	592
WAØCPX	Edward C. Gray	550

SSB

W4OPM	Joe Hiller	925
W4NJF	Gay E. Milius	857
DL1MD	Heribert Rechl	700
HP1JC	Juan G. Chen	698
WA5LOB	James Edwards	692
DL9OH	Karl Muller	690
K2POA	Arthur Johnson	683
F2MO	Michel Dort	632
K1SHN	Chuck Banta	626
G3DO	D. A. G. Edwards	622
W3DJZ	Arden B. Hopple	620
I1AMU	Alfonso Porretta	619
I1KDB	Diampaolo Nucciotti	599
W4IC	George Mack	562
W6YMV	Paul Friebertshauser	553

CW

W4OPM	Joe Hiller	850
W8KPL	William Simpson	816
W8LY	Michael A. Bakos	786
W2AIW	Charles W. Rodgers	776
DL1QT	Helmut Baumert	764
VK3AHQ	Henry Denver	753
W2HO	W. Vollkommer	720
ON4QX	Bob Berge	682
W9FD	W. W. Johler	680
WB2FMK	Robert Rasche	628
G2GM	F. D. Cawley	627
K1SHN	Chuck Banta	611
VE4OX	D. E. McVittie	579
I1SF	Serafino Franchi	571
YU1AG	Djura Borosic	569
W8GMK	John Marhefka	562
OK2QX	Ing. Jiri Pecek	556
K1LWI	Wendell Boyden	550

PHONE

W9WHM	John R. Leary	813
G3DO	D. A. G. Edwards	708
CX2CN	Samuel Barreiro	674
W3DJZ	Arden B. Hopple	654
CT1LN	Paulo J. S. Coelho Vieira	619
I1SF	Serafino Franchi	568

The WPX Program

S.S.B. WPX

564.....DL2EB
565.....HB9AHQ
566.....F3VN/W2
567.....CR7IC
568.....CR7IK
569.....VP9GE
570.....OX5AP
571.....YV1LF

C.W. WPX

1070.....KØEKR
1071.....WB4KZG
1072.....DJ3LR
1073.....EA1CP
1074.....I1BVS

Phone WPX

202.....K4SKI

Mixed WPX

259.....LZ1KPG
260.....K1AGB
261.....YU2NEG
262.....W9NVJ
263.....VK7DK

WPNX

25.....WN6IRT/4

VPX

28 (S.S.B.).....WPE6HLK

WPX Endorsements

S.S.B.: HP1JC–700, DL1MD–550, I1BGJ–550, WB2RLK–500, WØYDB–500, K2POA–500, WØGYM–500, CR7IC–500, XE1J–450, OX5AP–450, W6ZC–400, K7KNQ–350, CR7IK–300, and VP9GE–250.

C.W.: K2AAC–600, WØBK–600, DL1MD–500, WA6JVD–450, W4IP–400, KØIEA–400, DJ3LR–400, and WA3GNW–400.

Phone: WA6JVD–500, W4WSP–450, and K4SKI–450.

Mixed: W3PVZ–750, W4BQY–700, DL1-MD–700, YU2NEG–500, and W9NUJ–450.

40 Meters: OK2QR

20 Meters: XE1J

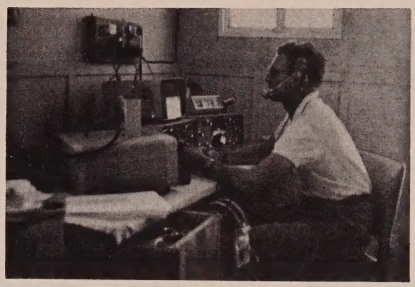
15 Meters: W9WCE and OK2QR.

Asia: OK2DB

Europe: DJ3LR and EA1CP

Oceania: WØYDB

Complete rules for WPX, WPNX, and VPX are shown on pages66-67 of the June, 1970 issue of *CQ*. Application blanks and reprints of the rules may be obtained by sending a self-addressed, stamped envelope to Award Manager, P.O. Box 1271, Covina, CA 91722, or to the DX Editor.



This is OD5BZ operating from MP4QBK during Qatar DXpedition from February 21-28, 1970.

Amateur Radio in Denmark

The information for this article was compiled by Henry F. Meiseles, K2UOC, who has worked and studied in Denmark.

"Radio in Denmark is a very native institution. Much of the earliest experimentation in radio communication was conduced by Danish researchers–chief among them Valdemar Poulsen with his work on the spark-gap transmitter in 1904, and Einer Dessau with his development of a spark radio-telephone device in the same year.

"From my own observations there is a high level of sophistication in Danish amateur radio, and certainly a great deal of activity. Nearly all the technical people I have met are competent in English, and most of the published material available to American and English amateurs is also utilized here.

"Amateur licenses in Denmark number over 4,100–the same proportion to the total population as in the United States–although requirements are reasonably high. There are 3 classes of license–A, B, and C in descending order of requirements and privileges. All 3 classes require the same code test which is 60 characters or about 12 words per minute.

"The first license which a Danish amateur obtains, Class C, requires that the applicant be at least 16 years old and pass an oral technical exam in addition to the code test. After he holds the Class C license for at least one year, or passes a written technical exam, he graduates to Class B. After a year in Class B, the 18 year old applicant takes a written technical exam for Class A.

"The Danish amateur organization–Experimenterende Dansk Radio (E.D.R.)–is parallel in purpose and structure to the A.R.R.L. It conducts weekly meetings through 10 months of the year at its Copenhagen club facilities. These meetings are of a varied character with activities ranging from formal lectures in communications and electronic theory to auctioning of components and equipment.

"There is a great deal of interest among young Danes in the further development of Danish amateur radio. Many conduct experiments using the latest solid state and IC circuit designs, finally utilizing them in the construction of their permanent equipment. I

Left to right, Tom, MP4BHH, Dave, MP4QBK, and station op Mike during the Feb., 1970 DXpedition to Qatar, See story below. *(Photo courtesy K4MQG).*

definitely say there is nothing rotten in the state of Danish amateur radio."

New and Rare Prefixes

CG6–CG6PH on 28035 is reported to be a new prefix for Cuba.

KA8–KA8FY represents a rare KA prefix catch. He has been heard on 14012 kc.

PZ–Surinam is now split into call districts. PZ5 is the prefix for visitors, while PZØ is the prefix used by the Surinam Radio Club.

WV4–WV4GS, a US Virgin Islands novice station, is very active on 21.120. He QSL's direct for all cards received.

YB –YBØAU was reported in 14019 kc at 1300 GMT.

YO –Several YO2 stations operated / YOØ to celebrate the 700th anniversary of County Timis, Roumania.

3B9–Alex, 3B8DA, hopes to operate this year from Rodriguiz as 3B9DA.

4T4–4T4LM was a special Peruvian call. QSL to W2GHK.

4W –LA8YB/4W continues active. He was last heard here around 14020 kc at 2330 GMT.

8J1–8J1RL is a Japanese operator in the antarctic. QSL via JARL.

The MP4QBK DXpedition by Tom, MP4BHH

(This DXpedition was one of the highlights of the 1970 DX years. It was well-planned and well executed.–*K4IIF)*

Most DXers dream of being "on the other end" one time. I am no different except that I made it, and giving a new country to 6000 other amateurs was one of the most satisfying experiences of my life.

Several locations were considered when I started my plans. However, in the Middle East where I have lived and traveled for over 7 years, Qatar seemed to be in greatest demand so it was chosen.

Next was the selections of operators. This was important to me as I wanted to have a DXpedition of which everyone could be proud. Other than considering the distances they would have to travel, the virtues of courtesy, temperament, perseverance, patience, and voice qualities were evaluated. [So that's why nobody ever invites me on their DXpeditions–*K4IIF*]

On my first visit to Doha I met Dave Kane, MP4QBK, and found him a very helpful and congenial host. He was the only holder of a Q license still residing in Qatar, and when we had difficulty obtaining a special call for the DXpedition he became our ace in the hole. Using his call was perfectly legal as long as he was present and we operated from the QTH registered on his license.

Our greatest concern was getting the necessary gear into Qatar. However, we finally worked this out, and I was able to go down a week ahead to set up the rig and see that everything was in working order.

During the final weeks prior to the DXpedition Dave was hospitalized for back surgery. We seriously considered cancelling the operation since his presence was required. Fortunately he was able to move around by the time I took the rig down.

Those scheduled to take part in the operation included Don, SVØWI, Bob, OD5BZ, and Henry, MP4BHV. Unfortunately, official duties kept Don at home and forced Henry to limit his visit to 24 hours. Consequently, Bob and I did the lion's share of the operating.

Considerable diversion was provided by Mahmood, a wild donkey gone domestic, whose favorite pastime was chewing the guy ropes. On one occasion the beam was saved only by a flying tackle.

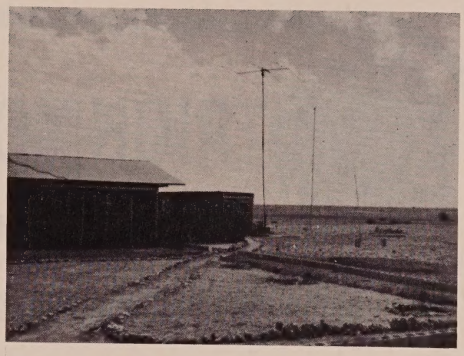
We extend our sincere thanks to Kuwait Airlines who provided round trip tickets for Bob, to Gulf Aviation who furnished round trip transportation to Henry and myself, to Middle East Airlines who designed and printed the QSL cards, and most of all to Gary, K4MQG, who did a fabulous job as QSL Manager.

QSL Information

The following amateur volunteers to serve as QSL Manager for a DX station: WA2HZR, 5562 Bear Rd., Apt. M6, North Syracuse, N.Y. 13212.

The stations now using DL7FT as QSL Manager include: EA6AR, EA6AS, EA6BG, EA6BH, EA6BJ, F9UC/FC, HBØLL, HS1CB, KH6GQW, KL7EBK, KR6JT, KZ5EK, OY2A, TA2AE, TF3ST, TF5TP, TU2AY, TU2AZ, TU2BB, XW8BP, XW8CN, YB1BM, ZA2RPS, 3A2CN, 3AØCU, and 3V8BZ.

CE9AT—Via CE3RR.
CP9AB—To K3SWZ, 3600 March Drive, Camp Hill, Pa. 17011.
CR6GA—c/o WA3HUP.
CR7FR—Via W2GHK.
CT2AA—To WA3HUP.
EA8GZ—c/o VE7BWG.
ET3USA—Via VE3IG.
FØKI—To G2DHV.
FB8YY—c/o F9MS.
FG7TI/FS7—Via VE3EUU.
FY7AE—To WA4WTG, 445 N. W. 202 Terrace, Miami, Fl. 33169.
FY7YD—c/o VE3ACD.
G5ATA—Via W6YY.
HC8GS—To W5GTW.
JW1EE—c/o W2GHK.
KC6RM—Via W6DOR, 4100 Worthington Dr., North Highlands, Ca. 95660.
KP4DJI—Tom Fitzpatrick, P.O. Box 219, APO New York 09845.
LA8YB/4W—To LA3BI.
MP4MBB—c/o G3LQP.
OHØAA—Via OHØNI.
ON8IR—To G2DHV.
PAØDHV—c/o G2DHV.
PJ8DZ—Via W9ZRX.
PJØFC—To W1FJJ.
TA1AM—c/o K4EPI.
TR8MC—Via W2YY.
TY9ABC—To DJ1QP.
VK6CIF—c/o W2GHK.
VP2AAC—Via WB4GAA, 9 Campbell St., Greenville, S.C. 29607.
VP2EE—To W9ZRX or VE3EUU.
VP2KM—c/o W9ZRX.
VP8LK—Via G3NOM.
VP9GR—To W2GHK.
VQ9SM—c/o JAØCUV.
VU2BFO—Via W3BWZ.
XEØQB—To W5QBM, 2508 Big Horn, Richardson, Tx. 75080.
XT2AB—c/o DJ1QP.
XT2AC—Via DJ6QT.
YV5AK—To W7HKI, Traveler's Lodge, Edmonds, Wa. 98020.
ZD3N—c/o DJ1QP.
ZD3P—Via DJ1QP.
ZF1AN—To W2HAQ.
ZK1CD—c/o ZL2FA.
ZK1MA—Via KH6GLU.
ZM4OL—To ZL2GX.
ZM4JF—c/o ZL2AFZ.
ZM7AG—Via VE7BWG.
ZM7AH—To VE7BWG.
ZS2MI—c/o ZS6LW.
ZS3AW—Via DJ3KR.
3B8CR—Moulin Casse, Peyrebere, Grand 'Baie, Mauritius.



Operating shack of MP4QBK.

3B8CZ—To G3LQP.
4X4NJ—c/o WA4WTG.
4X4UF—Via WA4WTG.
4X4VB—To WA4WTG.
4Z4AI—c/o WA2KWP, 17 Orchard Rd., Middlesex, N.J. 08846.
4Z4BG—Via WA4WTG.
4Z4DX—To WA4WTG.
4Z4EA—c/o WA4WTG.
4Z4IB—Via WA2KWP.
5N2AAU—To WA9UFV.
5R8AP—c/o WB4GQH.
6W8DY—Via VE4SK.
6W8GE—NOT via WB2KHO.
7P8AZ—To VE2JH.
7Q7AA—c/o W2CTN.
9X5AA—Via W1YRC.
9Y4VU—To WA3EPB.

73, John, K4IIF

The WAZ Program

The following list is based on applications received between Nov. 1 and Nov. 30, 1970.

S.S.B. WAZ

825.....K8DYZ	828.....W3AZD
826.....VK7DK	829.....G3RWQ
827.....JA1CB	830.....W7BJ

C.W.—Phone WAZ

3046.....K2BMI	3055.....EP2DX
3047.....VE1AE	3056.....I1CKK
3048.....K1EUW	3057.....G3SYC
3049.....CE4AD	3058.....G3MPN
3050.....VE1AI	3059.....SP8JM
3051.....WØSDN	3060.....W3DPA
3052.....W4SYL	3061.....4X4FU
3053.....K9ENC	3062.....W8OKB
3054.....DJ6RX	3063.....WA9LZA

Phone WAZ

448.....W7RI

Complete WAZ rules are shown on pages 64-66 of the June, 1970 issue of *CQ*. Application blanks and reprints of the rules may be obtained by sending a self-addressed, stamped envelope to DX Editor, P.O. Box 205, Winter Haven, Fl. 33880.

PICK YOUR PERFORMANCE IN

hy-gain/galaxy

FM-210 2 Meter Transceiver

Capability...That's what you purchase from Hy-Gain/Galaxy. Top performance from the first mass produced 2 meter transceiver. Fixed or mobile, the FM-210 will provide maximum pleasure with minimum investment. **And all American made too! No parts problems and backed by Hy-Gain's famous Customer Service!**

Top performing transceivers coupled with your choice of the world's best 2 meter antennas means a winning combination with capability...

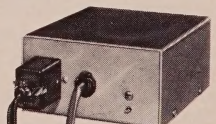
SPECIFICATIONS:

Transmitter:
- Frequency Range: 143-149 MHz
- Antenna Impedance: 50 ohms nominal
- Power Requirements: 12-14v DC
- Transmitter: 5 watts (10w with AC-210 power booster)
- Microphone: High Z
- Deviation: Adjustable narrow or wide band with clipper filter also adjustable for optimum clipping lever

Receiver:
- Sensitivity: SINAD .5 uv for 12 db
- Quieting: 1 uv provides 20 db
- Squelch: Continuously adjustable
- Modulation Acceptance: FM wide band (narrow band available on special request)
- RF Circuitry: FET front end and duo conversion for minimum cross modulation and overload
- IF Frequency: 10.7 MHz and 455 KHz.
- Frequency Control: 3 channel transmit, 3 channel receive. (146.94 MHz furnished) Transmit and receive frequencies independent of each other
- Audio Output: 3 watts from internal 3.2" speaker

Order #813. Price $229.50

AC-210 POWER BOOSTER



Use the AC-210 on 115v AC or 12v DC to provide AC operation and 10 watts input. Supplied with mounting brackets for permanent mobile installation. Order #814. Price $49.00.

MMB MOBILE MOUNTING BRACKET

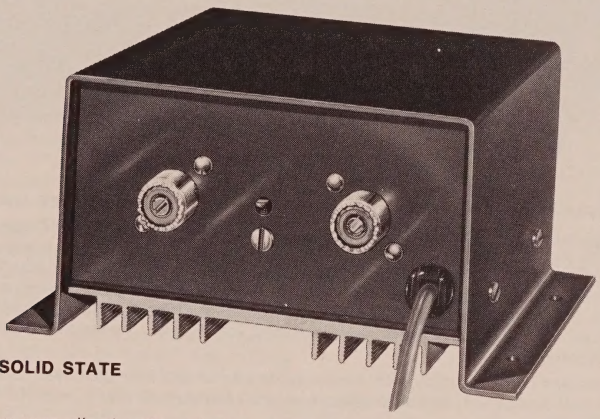
Mounting bracket provides positive mounting and quick disconnect for easy removal. Between half of the mount is removable when not being used to conserve space.

Order #816. Price $5.95

E IN A WINNING COMBINATION

hy-gain/galaxy

PA-210 2 Meter 35 Watt Mobile Amplifier



SOLID STATE

This all new ruggedized solid state two meter mobile amplifier provides 35 watts output to greatly increase your communication range. The PA-210 is a must for areas where no repeater is available. The PA-210 is designed as a companion for the FM-210. (When used as a system, the AC-210 power booster is not required.) A unique circuit protects the output transistor from voltage spikes and surges. All change over relay functions are internal and controlled by FM-210 circuitry through a connecting cable.

SPECIFICATIONS:

- Input Voltage: 12v DC, negative ground only
- Power Input: 60 watts
- Power Output: 35 watts
- Frequency Range: 143 MHz to 149 MHz
- Operation: Class C
- Drive Requirements: 5½ watts required for 35 watts output (the PA-210 provides operating voltages to the FM-210 for high power operation)
- Antenna Requirements: 50 ohms unbalanced

Order #815. Price $149.95

HY-GAIN 764 ⅝ WAVE GAIN ANTENNA FOR TWO METER MOBILE

Model 764 ⅝ wave antenna with 3 db gain professional mobile antenna for two meters provides the highest gain and best matched performance (52 ohms) than any other mobile antenna on the market. Handles 110 watts and is constructed of 17-7 ph stainless steel with chrome plated hardware. It features an etched copper matching coil on a G10 epoxy fiberglass board. Exclusive claw mount fits any size hole ⅜ to ¾". Easy installation and high power capability. Supplied with 22' of RG-58/U coax and PL-259 connector.

Order #764. Price $26.50

-Gain 764 Gain Antenna
2 Meter Mobile

GALAXY ELECTRONICS DIVISION

HY-GAIN ELECTRONICS CORPORATION

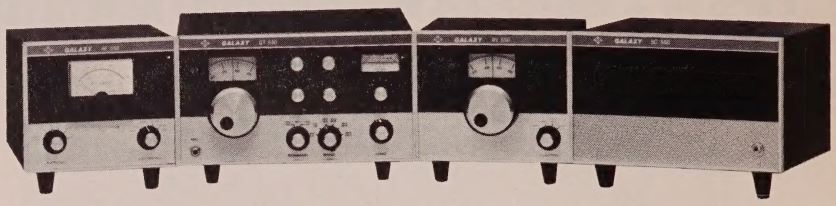
P.O. Box 5407-FC, Lincoln, Nebraska 68505

The most powerful signals under the sun!

THE GALAXY 550

MORE POWER, MORE FLEXIBILITY FOR THE Fixed Station...

LC 75T



GT-550 Transceiver Order No. 800 Ham Net $550.00

The GT-550 is the best transceiver on the market for the money. Bar none. Costs just $550 and delivers 550 watts of power. Operating either fixed station or mobile, this transceiver is guaranteed to have a top frequency stability after warm-up. We're so proud of the stability we include a graph with each GT-550 showing the purchaser how stable his radio was when it went through final check. 550 watts SSB; 360 watts CW; sensitivity better than .5 uv for 10 db S+N/N; stable—45 db carrier suppression; 25 KHz calibrator and vox option; no frequency jump when you switch sidebands.

RF550 contains high accuracy watt meter; calibrated in 400 and 4,000 watt scales; switch for forward or selected power; switch to select 5 antennas or dummy load. Order No. 805 Ham Net $75.00

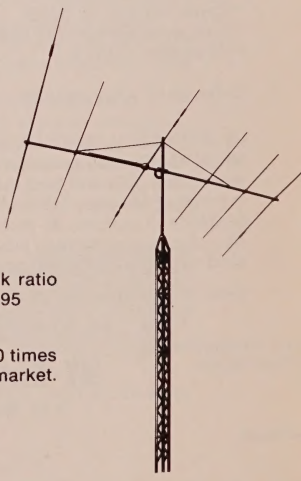
RV550 is a solid state VFO. Function switch selects the remote unit to control **Receive-Transceive-Transmit** frequency independently. Order No. 804 Ham Net $95.00

SC550 Speaker Console with headphone jack. AC400 power supply will mount inside. Order No. 803 Ham Net $29.95

AC400 Power Supply is heavy duty solid state to operate GT550 at full power, on SSB or CW, and with switch selection of 115/230 VAC, 50/60 Hz input voltages. Order No. 801 Ham Net $99.95

Hy-Gain's *Super Thunderbird* TH6DXX

• "Hy-Q" Traps • Up to 9.5db forward gain • 25db front-to-back ratio • SWR less than 1.5:1 on all bands • Takes maximum legal power • 24-foot boom. Order No. 389 Ham Net $179.95



Hy-Gain's 14AVQ/WB

• New wide band operation • "Hy-Q" traps • 12" double-grip aluminum mast bracket • Taper swaged seamless aluminum construction • DC ground to drain off precipitation static. Order No. 385 Ham Net $ 39.95

Hy-Gain's Thunderbird TH3Mk3 (not shown)

• "Hy-Q" traps • Up to 8db forward gain • 25 front-to-back ratio • Takes maximum legal power. Order No. 388 Ham Net $144.95

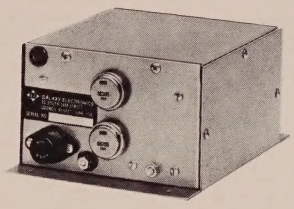
Hy-Gain's 400 Rotator/Indicator

• Handles large beams and stacked arrays with ease—up to 10 times the mechanical and braking capability of any rotator on the market. Order No. 400 Ham Net $189.95

TOTAL SYSTEM

MONEY THAN ANY OTHER SYSTEM ON THE MARKET!

Mobile...



GT-550 Transceiver Order No. 800 Ham Net $550.00
Mobile, too, the GT-550 delivers more for the money. More power, more sensitivity, more stability and the best signal plus noise to noise ratio. Mounts under dash or over hump. See opposite page for more details.

G 1000 DC power supply for GT-550 mobile applications. Order No. 802 Ham Net $129.95

Hy-Gain's Hamcat 257 Mobile Antenna

• More power capability with lower VSWR • Higher Q plus broad band performance • Higher radiation effectiveness • Lightweight, super strength construction • Shake-proof sleeve lock folds over for garaging • Lightweight precision wound coils • Swivel base

Order No. 257	All new design 5' long heavy duty mast of high strength heavy wall aluminum tubing	$16.95
Order No. 252	75 meter mobile coil	$19.95
Order No. 256	40 meter mobile coil	$17.95
Order No. 255	20 meter mobile coil	$15.95
Order No. 254	15 meter mobile coil	$12.95
Order No. 253	10 meter mobile coil	$10.95

Hy-Gain Heavy Duty Bumper Mount Model BPR

• Rugged stainless steel construction • Handles full size heavy whip • Clamps to most car bumpers. Order No. 415 Ham Net $8.95

Hy-Gain Flush Body Mount Model BDYF

• Chrome plated body mount with molded cycolac base • Provides rugged support for antenna with or without spring. Order No. 499 Ham Net $6.50

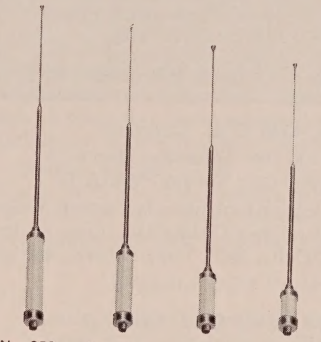
Hy-Gain Deluxe Spring Model SPG

• Heavy-duty chrome-plated double tapered steel spring with both ends tapered for perfect alignment. Order No. 417 Ham Net $5.95

Hy-Gain Extra Heavy Duty Spring Model SPGH

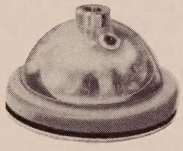
• Chrome-plated and designed especially for rigid support of heavy mobile antennas • Order No. 511 Ham Net $8.95

Buy your complete fixed station or mobile system from one source and take advantage of Hy-Gain's complete customer service. Buy from the world's largest manufacturer of Amateur equipment.



No. 256 40 Meter | No. 255 20 Meter | No. 254 15 Meter | No. 253 10 Meter

415



499

417
511

No. 257

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a subsidiary of
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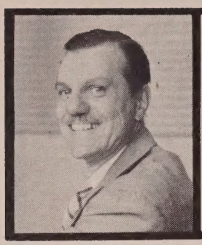
P.O. Box 5407-FA, Lincoln, Nebraska 68505



Contest Calendar

BY FRANK ANZALONE,* W1WY

Calendar of Events

Mar.	6-7	ARRL DX Phone Contest
Mar.	6-8	World Wide VHF Activity
Mar.	13-14	Helvetia XXII Contest
Mar.	13-14	RSGB BERU C.W. Contest
Mar.	13-14	YL-OM C.W. Contest
Mar.	13-15	BARTG RTTY Contest
Mar.	13-15	Virginia QSO Party
Mar.	13-21	QRP ARC QSO Party
Mar.	20-21	ARRL DX C.W. Contest
Mar.	**27-28**	**CQ WW WPX SSB Contest**
Mar.	27-28	New Mexico QSO Party
Apr.	2-5	Old, Old Timers QSO Party
Apr.	3-4	Florida QSO Party
Apr.	3-4	SP DX C.W. Contest
Apr.	3-11	IARC Propagation Phone
Apr.	10-11	Novice QSO Party
Apr.	24-25	PACC DX Contest
May	21-23	YL Inter. SSBers QSO Party

YL-OM C.W. Contest

Starts: 1800 GMT Saturday, March 13
Ends: 1800 GMT Sunday, March 14

The phone section took place last month. Rules appeared in January's CALENDAR. Logs go to: Mae Hipp, K7QGO, 5655 Yukon Drive, Sparks, Nevada 89431.

RSGB BERU C.W. Contest

Starts: 0001 GMT Saturday, March 13
Ends: 2359 GMT Sunday, March 14

This one has been around a long time, 34 years to be exact. It's open to RSGB members only, residing in the British Isles and amateurs licensed to operate within the British Commonwealth and British Mandated Territories.

We have not received any official announcement but I am sure those eligible to participate know what it's all about.

Last year the logs went to: BERU, RSGB HF Contest Committee, c/o J. C. Graham, G3TR, "The Willows" Church Road, Lowfield Heath, Crawley, Sussex, England.

World Wide V.H.F. Activity

Starts: 1900 GMT Saturday, March 6
Ends: 0300 GMT Monday, March 8

This is a new activity organized by the Itchycoo Park VHF ARS, the object to create more activity on the v.h.f. bands above 30 mc.

Exchange: Area location; state for W/Ks, province for VEs and country for all others.

Scoring: One point per contact regardless of band. Final score, multiply QSO points by the different areas worked on each band.

Awards: Certificates will be awarded to each station submitting a log meeting the following requirements: At least 50 contacts on any v.h.f. band below 144 mc, or 25 contacts on the 144 mc band, or 20 contacts in the combined bands above 148 mc.

Separate awards for the high scorers in each US call area, Canadian province and each country.

Mailing deadline is April 1st to: Itchycoo Park ARS, WA3NUL, P.O. Box 1062, Hagerstown, Maryland 21740.

Helvetia XXII Contest

Starts: 1500 GMT Saturday, March 13
Ends: 1700 GMT Sunday, March 14

This is one of the more popular European contests and the HB boys make every effort to activiate all 22 Cantons.

Contacts may be made on all bands, 1.8 thru 30 mc. The same station may be worked on each band and mode for QSO and multiplier credit.

Exchange: The RS/RST report plus a progressive contact number starting with 001. Swiss stations will also include their Canton. (ie: 579001/ZH)

The 22 Cantons are: AG, AR, BE, BS, FR, GE, GL, GR, LU, NE, NW, SG, SH, SO, SZ, TG, TI, UR, VD, VS, ZG, ZH.

Scoring: Each contact 3 points. The multiplier is the sum of cantons worked on each band, a possible 22 on each band.

Final score, total QSO points multiplied by the sum of Cantons from all bands.

Awards: Certificates to the top scorer in each country. (VE & W/K call areas?)

Logs: Use a separate sheet for each band, indicate a Canton the first time it is worked, and check your log for duplicate contacts and accuracy. Include a summary sheet showing the scoring and other information, your name and address in BLOCK LETTERS, and a signed declaration that all rules and regulations have been observed.

Mail your log within 30 days to: Al F. Egli, HB9AAA, USKA Traffic Mgr., Box 17, 2500 Bienne 4, Switzerland.

*14 Sherwood Road, Stamford, Conn. 06905.

B.A.R.T.G. Spring RTTY Contest

Starts: 0200 GMT Saturday, March 13
Ends: 0200 GMT Monday, March 15

This one is organized by the British Amateur Radio Teleprinter Group. All bands may be used, 3.5 thru 28 mc. and the same station may be worked once per band.

Exchange: Time GMT, Qso nr. and RST.

Points: Contacts within one's own country earn 2 points. Contacts outside own country 10 points. A bonus of 200 points will be earned for each new country worked on each band.

Multiplier: The multiplier is the total of countries worked from each band, and the continents worked. (max. of 6)

Scoring: (a) Exchange points X countries. (b) Bonus points X continents.

Add totals of (a) and (b) for final score.

Use ARRL country list, with KL7, KH6 and VO considered as separate countries.

Not more than 36 hours out of the 48 hour contest period may be used. The non-operating period may be taken any time but not less than in two hour periods. Note time on/off on log.

Awards: Certificates to the leading stations and also s.w.l. RTTYers.

Logs must be received by May 22nd and go to: Ted Double, G8CDW, BARTG Contest Mgr., 89 Linden Gardens, Enfield, Middlesex, England.

QRP ARC QSO Party

Starts: 0000 GMT Saturday, March 13
Ends: 2300 GMT Sunday, March 21

This contest is open to all amateurs, whether or not they are members of QRP ARC International. It's a week long activity on c.w. only.

Exchange: RST, ARRL section or country and QRP number. Non-members send "NM" and their power input.

Scoring: 3 points for each QRP member worked, 4 points if it's a DX member. Non-member QSO's 2 points. The multiplier is determined by the ARRL sections and countries worked on each band.

There is also a power multiplier as follows: Max. of 100 watts input, no multiplier. 25 to 100 watts, 1.5; 5 to 25 watts, 2.; 1 to 5 watts, 3.; and less than 1 watt output, 4.

Final Score: QSO points × Multiplier × Power multiplier. (The same station may be worked on each band for QSO and multiplier credit.)

Frequencies: 3540, 7040, 14065, 21040 and 28040. Novices, 3710, 7160, 21100.

Awards: Certificates to highest scoring station in each ARRL section and country. Also to the top three W/VE and DX stations. The lowest power station with at least 3 skip contacts will also receive an award.

Claimed Scores 1970 CQ WW DX C.W. Contest

Single Operator
All Band

KH6RS	2,064,575
UA9ABA	1,719,663
KH6IJ	1,355,508
K3HTZ	1,181,521
EP2BQ	1,081,415
VE1ASJ	1,075,647
W3GRF	1,023,178
ZM1AJU	1,009,750
W6RR	975,066
W3WPG	963,850

28 mc

K1LWI	138,132
VE1TG	135,594
W9YYG	99,246
K4KJN	93,330
W1NU	78,351
W4CRW	68,068

21 mc

WA8LYF	286,767
K1HVV	190,722
WA8QIY	183,480
W1MDO	173,124
WAØCVS	168,386

14 mc

PY4AP	652,974
3B8CR	450,018
ZE1CU	332,010
W1WAI	180,608
WØIYH	152,208

7 mc

EL2BZ	162,603
YV5AW	87,730
K1ZND/1	87,482
YV5KL	81,832
W6MAV	53,850

3.5 mc

W3MFW	60,768
PZ1AH	34,914
W2YT	16,801
W9HUZ	15,996
W8HBK	15,600

1.8 mc

DL1CF	5,206
HB9NL	3,536

Multi-Operator
Single Transmitter

HH9DL	3,302,640
4M5ANT	2,657,892
W9EWC	1,327,880

Multi-Operator
Multi-Transmitter

PJØFC	11,500,000
W3GM	4,076,791
K6RU	2,860,116
WØAIH	1,314,789

A summary sheet showing the scoring, equipment and power used, and a signed declaration that all rules have beeen observed and the power declaration is true, is also requested.

Mailing deadline is April 10th to: Elmer J. Worth, K3YNN, 946 Franklin Street, Reading, Pa. 19602. A s.a.s.e to K3YNN will get you any information you need regarding the QRP ARC.

Virginia QSO Party

Starts: 1800 GMT Saturday, March 13
Ends: 0200 GMT Monday, March 15

This annual QSO party is again being sponsored by the Roanoke Valley ARC. Phone and c.w. are separate contests and separate logs should be submitted. The same station may be worked on each band for QSO point credit.

Exchange: QSO nr., RS/RST and QTH. County for Va. stations; state, province or country for all others.

Scoring: One point per QSO. Virginia multiply QSO's by number of states, VE provinces, countries and VA. counties worked. Others multiply VA. QSO's by number of VA. counties worked. (max. of 96)

Frequencies: c.w.—3560, 7060, 14060, 21060, 28060. Phone—3930, 7235, 14240, 14340, 21310, 21400.

Awards: Certificates to the highest scoring station in each state, province and country. Virginians will receive awards for 1st thru 5th places.

Logs must be received no later than April 30th

1970 SP DX Contest Results

All Band

WØBMM	9,648
WA3LNM	6,804
W4KMS	6,201
W2KHT	3,720
W2NCG	2,160
W6JPH	1,380
WA1IOB	1,134
W6DGH	867
W9QWM	588
WAØZLU	48

28 mc

WA2HZR	816

21 mc

WA3MQJ	2,856
WAØEPG	1,254
W6ISQ	918
W3EGN	864
W9GBS	468
WB9AHJ	6

14 mc

W5GR	9,306
W1DS	5,733

Canada
All Band

V01AW	36,972
VE2IL	6,552

21 mc

VE3EDC	1,701

14 mc

VE1AE	2,688

and go to: Roanoke Valley ARC, Att: Van A. Wimmer, WA4BIX, Route 4, Box 446, Salem, Virginia 24153.

Include a s.a.s.e for results.

SP DX C.W. Contest

Starts: 1500 GMT Saturday, April 3
Ends: 2400 GMT Sunday, April 4

The object of the contest is to work as many Polish amateurs in as many different SP powiats as possible.

There are two categories; single operator, single and all band; and multi-operator, all band only.

Exchange: RST report plus a 3 figure QSO number starting with 001 for foreign stations. Polish stations send the RST plus their powiat letters. (ie: 579 WA and etc.)

Scoring: Each QSO with a SP or 3Z station counts 3 points. Score a multiplier of 1 for each different powait worked.

Final Score: Total QSO points multiplied by the sum of different powaits. The same station may be worked on each band for QSO points, but a powiat may be counted only *once* as a multiplier.

Awards: Certificates to the top scorers in each category, in each country, with 2nd and 3rd place awards where returns justify.

Contest contacts may be credited for the PZK awards if verified by the logs of SP stations. Applications may be made with your contest log, include a fee of 7 IRCs.

Use a separate sheet for each band and include a summary sheet with all the scoring information and a signed declaration that all rules and regulations have been observed. Duplicate contacts in excess of 3% means disqualification, so check log thoroughly before submitting it.

Mailing deadline is May 1st and logs go to: Contest Manager od PZK, P. O. Box 320, Warszawa 1, Poland.

Editor's Notes

I see by an item in "Operating News" *QST*, page 105 Dec. '70, that a commercially sponsored contest was even mentioned in a discussion about major contests. How about that? Could they possibly be referring to our World Wide DX Contest? Not that we consider it a commercial venture. Now that we have broken the ice, maybe a little more recognition in the future? Incidently we are in full agreement that a "contest forum" should be on the agenda of all Conventions.

The "Claimed Scores" are only a few of the higher early bird scores received from the C.W. Contest. I found conditions rather good, especially on 10 and 15, easily meeting the normal conditions predicted by W3ASK. Score another one for George.

Rules for the WPX SSB contest, the last week-end this month, will be found on page 31. Same rules as last year, with rest periods and double QSO points on 40, 80 and 160. Don't forget, the prefix multiplier is counted only *once* in the contest, not once on each band. Wonder what the Brazilians will come up with this year.

We were saddened to hear of the passing of Jake Schott, W8FGX on November 21st after an illness of several months. Up to a few years ago Jake was an avid DXer and contester, especially on 40 meters. However he had not been active the past few years due to pressure of work as Police Chief for the City of Cincinatti. May he "Rest in Peace."

73 for now, Frank, W1WY

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CQ Magazine
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Propagation

BY GEORGE JACOBS,* W3ASK

THIS month marks the beginning of my *twenty-first* year as *CQ's* Propagation Editor.

In 1946 *CQ* pioneered propagation forecasts for radio amateurs with the introduction of a monthly column edited by my good friend Perry Ferrell, who is now Editor of *Popular Electronics*. Perry's column was temporarily discontinued in 1950.

In response to many requests to bring back the Propagation column, about a year later Gene Black, W2ESO, the then Editor of *CQ* asked me to prepare it. The first column under my editorship appeared in the March, 1951 issue of *CQ*. It was intentionally left out of the April issue to assess response. It appeared again in the May issue, and although the format has changed somewhat during the years, and I have had to prepare some of the columns in such strange places as Swiss mountaintops, on the plains of Spain, in the jungles of Africa, and in the middle of an Asian war, the predictions have appeared each month since then for the past twenty years!

Propagation specialists often measure events in terms of sunspot cycles rather than in years or months. My editorship of this column began during the declining years of Cycle 18, continued through the record breaking 19th cycle, and has seen the start, peak and now the decline of Cycle 20.

CQ intends to continue to bring radio amateurs the very latest propagation predictions and forecasts each month on the pages of this column.

March Conditions

During March and continuing into April, relatively similar h.f. radio propagation conditions exist in the temperate regions of both the northern (where it is spring) and southern (where it is fall) hemispheres, as compared to the more extreme conditions that exist when it is summer in one and winter in the other. As a result, h.f. propagation conditions between both hemispheres are usually at their best during March and April. Usable frequencies are at their seasonally highest values and signal intensities should be at their strongest levels. Good inter-hemisphere openings are expected on all amateur bands between 10 and 40 meters, with the possibility that some openings may also occur on 80 and 160 meters. Typical of these openings are the paths between the United States and South America, Australasia and the central and southern regions of Africa.

In the northern hemisphere springtime propagation conditions begin during March. These are typified by fewer east-west openings on 10 meters, and as the hours of daylight increase both the 15 and 20 meter bands remain open

*11307 Clara Street, Silver Spring, Md. 20902.

LAST MINUTE FORECAST

Day-to-Day Conditions and Quality for March, 1971

	Forecast Rating & Quality			
	Days (2)	(1)	(4)	(3)
Above Normal: 1, 14, 18-19, 28.	B	B-C	A	A-B
Normal: 2-4, 8, 12-13, 15-17, 20-21, 24-25, 27, 29-31.	C	D	A-B	B
Below Normal: 5-7, 9, 11, 22-23, 26.	D	E	B-C	C-D
Disturbed: 10.	E	E	C-D	D-E

How To Use These Charts

The following is an explanation of the symbols shown above, and instructions for the use of the *CQ* propagation predictions:

1—Enter Propagation Charts on following pages under appropriate band and distance or geographical area columns. Read predicted times of band openings at intersection of both columns.

2—Following each predicted time of band opening is a forecast rating which indicates the relative number of days the band is expected to open during each month of the forecast period. The higher the rating, the more frequent the opening, as follows: (4) band open more than 22 days each month; (3) between 14 and 22 days; (2) between 2 and 13 days; (1) less than 7 days.

On the "Short-Skip" Chart where two numerals are shown within a single set of parenthesis, the first applies to the shorter distance for which the forecast is made, and the second to the greater distance. Note the forecast rating for later use.

3—With the forecast rating noted above, start with the numbers in parenthesis at the top of the "Last Minute Forecast" appearing above. Read down the table for a day-to-day forecast of propagation conditions in terms of Above Normal (WWV rating high than 6); Normal (WWV rating 5-6); Below Normal (WWV rating 4); Disturbed (WWV rating less than 4). The letter symbols (A-E) describe reception conditions (signal quality, noise and fading levels) expected for each day of the month and have the following meaning: (A—excellent opening with strong, steady signals; B—good opening, moderately strong signals, little fading and noise; C—fair opening, signals fluctuating between moderately strong and weak; D—poor opening, signals generally weak and considerable fading and noise; E—poor opening, or none at all.

4—This month's Propagation Charts are based upon a transmitter power of 75 watts c.w.; 150 watts s.s.b., or 800 watts d.s.b., into a dipole antenna one quarter-wave above ground on 160, 80 and 40 meters and a half-wave above ground on 20, 15 and 10 meters. For each 10 db increase above these reference levels, reception quality shown in the "Last Minute Forecast" will improve by one level; for each 10 db loss reception will become poorer by one level.

5—Local standard Time for these predictions is based on the 24-hour system.

6—These Propagation Charts are valid through May 15, 1971. These Charts are prepared from basic propagation, data published monthly by the Institute for Telecommunication Sciences of the U.S. Dept. of Commerce, Boulder, Colorado.

longer than during the winter months. Higher static levels, fewer hours of darkness, and seasonal increases in ionospheric absorption should result in somewhat poorer propagation conditions on circuits within the northern hemisphere on 40, 80 and 160 meters.

The following is a summary of h.f. amateur band propagation conditions forecast for March, 1971. For more specific information, refer to the DX Propagation Charts which appeared in last month's column. This month's column contains Short-Skip Propagation Charts valid during March and April, as well as Propagation Charts centered on Alaska and Hawaii. The Short-Skip Charts contain band opening forecasts for predominantly *one-hop* openings for distances varying between 50 and 2300 miles.

For day-to-day propagation conditions expected during March, see the "Last Minute Forecast", which appears at the beginning of this column.

10 Meters: While fewer DX openings are forecast, some fairly good ones still should be possible during the daylight hours, especially to southern and tropical areas. Some fairly good short-skip openings should also be possible between distances of approximately 1000 and 2300 miles. Conditions are expected to peak during the afternoon hours.

15 Meters: This should be the best band for DX propagation during most of the daylight hours. Excellent openings are forecast to most areas of the world during this period, with conditions peaking during the late afternoon hours. Some openings to southern and tropical areas may take place during the evening hours as well. Excellent short-skip openings are also forecast for most of the daylight hours, between distances of approximately 1000 and 2300 miles.

20 Meters: With longer hours of daylight, 20 meters should remain open for DX well into the evening hours. This should be the optimum band for DX openings during the sunrise period, and again during sunset and the early evening hours. The band is likely to remain open throughout the hours of darkness as well, especially to southern and tropical areas. Excellent short-skip openings are expected during the daylight hours, between distances of approximately 750 and 2300 miles, with many openings continuing through the evening hours.

40 Meters: Fairly good DX openings to many areas of the world from sundown through sunrise, with conditions peaking during the hours of darkness. Excellent short-skip openings are expected between a range of 50 and 750 miles during the daylight hours, and between approximately 500 and 2300 miles at night.

80 Meters: Some fairly good DX openings should be possible during the hours of darkness and the sunrise period. Static levels are expected to be higher, however, and the band noticeably noisier than during the winter months. Excellent daytime short-skip openings should be possible between 50 and 250 miles, with the distance increasing to between 200 and 2300 miles during the hours of darkness. DX conditions usually peak when it is darkness at the western terminal and sunrise at the eastern terminal of a path.

160 Meters: No openings on this band are expected during the hours of daylight, but short-skip openings up to a distance of 2300 miles, and an occasional DX opening should be possible during the hours of darkness and the sunrise period.

V.h.f. Ionospheric Openings

A seasonal increase in v.h.f. ionospheric openings is expected during March, resulting from increased occurances of sporadic-E propagation, auroral activity and trans-equatorial scatter.

A seasonal increase in short-skip openings due to sporadic-E propagation usually begins during March, andan occasional 6 meter opening may be possible during the month, over distances between approximately 1000 and 1300 mles.

Trans-equatorial scatter propagaton (TE) is also expected to increase during March, and some 6 meter openngs should be possible from the southern half of the United States to South America, up to a distance of approximately 5000 miles. TE openings must cross the magnetic equator at or near a right angle, and the optimum time for 6 meter openings is between 8 and 11 P.M., local time at the path midpoint.

There is usually a noticeable increase in auroral activity during March, and there is a good chance that a number of v.h.f. ionospheric short-skip openings should be possible by means of auroral-scatter propagation. Check the "Last Minute Forecast" at the begnning of this column for those days that are expected to be disturbed or below normal, since these are the days on which v.h.f. auroral openings are most likely to occur.

Not much meteor activity expected during March, although some v.h.f. meteor-type openings may be possible when minor meteor showers peak on March 16 and 26.

Sunspot Cycle

The Swiss Solar Observatory at Zurich reports a mean monthly sunspot number of 91 for November, 1970. This results in a 12-month smoothed sunspot number of 106 on May, 1970. Ths means that the plateau in the level of the present sunspot cycle, which began during April, 1969 with a smoothed sunspot number of 106, has continued for more than a year. (See "Sunspot Cycle 20—Progress 1970; Prediction 1971" in the January, 1971 issue of *CQ* for more details).

A smoothed sunspot number of 86 is forecast for March, 1971. 73, George, W3ASK.

CQ Short-Skip Propagation Chart
March & April, 1971

Band Openings Given in Local Standard Time at Path Mid-Point (24-Hour Time System)

Distance From Transmitter (Miles)

Band (Meters)	50-250 Miles	250-750 Miles	750-1300 Miles	1300-2300 Miles
10	*Nil*	09-13 (0-1)	08-09 (1) 09-12 (1-2) 12-15 (1-3) 15-17 (1-2) 17-20 (0-1)	08-09 (1) 09-12 (2) 12-15 (3) 15-17 (2-3) 17-18 (1-2) 18-20 (1)
15	*Nil*	08-09 (0-1) 09-15 (0-2) 15-18 (0-1)	07-08 (1) 08-09 (1-2) 09-15 (2-4) 15-17 (1-3) 17-19 (1-2) 19-21 (0-1)	07-08 (1) 08-09 (2) 09-15 (4) 15-17 (3-4) 17-19 (2-3) 19-21 (1-3) 21-22 (0-2) 22-23 (0-1)
20	11-13 (0-1) 13-15 (0-2) 15-17 (0-1)	07-08 (0-2) 08-11 (0-3) 11-13 (1-4) 13-15 (2-4) 15-17 (1-4) 17-19 (0-3) 19-21 (0-2) 21-07 (0-1)	06-07 (1-2) 07-08 (2-3) 08-11 (3-4) 11-17 (4) 17-19 (3-4) 19-21 (2-4) 21-22 (1-3) 22-00 (1-2) 00-06 (1)	06-07 (2) 07-08 (3) 08-10 (4) 10-15 (4-3) 15-21 (4) 21-22 (3-4) 22-00 (2-3) 00-04 (1-2) 04-06 (1)
40	06-07 (1-2) 07-09 (2-3) 09-19 (3-4) 19-21 (2-3) 21-23 (1-2) 23-06 (0-1)	06-07 (2-3) 07-09 (3-4) 09-11 (4-3) 11-13 (4-2) 13-15 (4-3) 15-19 (4) 19-21 (3-4) 21-23 (2-3) 23-03 (1-2) 03-06 (1)	06-07 (3-2) 07-08 (4-2) 08-09 (4-1) 09-11 (3-1) 11-13 (2-1) 13-15 (3-1) 15-17 (4-2) 17-19 (4-3) 19-21 (4) 21-23 (3-4) 23-03 (2-3) 03-06 (1-2)	06-08 (2-1) 08-15 (1-0) 15-16 (2-1) 16-17 (2-1) 17-19 (3-2) 19-23 (4) 23-03 (3-4) 03-06 (2-3)
80	07-08 (3-4) 08-11 (4) 11-18 (4-3) 18-21 (3-4) 21-23 (3-4) 23-02 (2-3) 02-05 (1-2) 05-07 (2-3)	07-08 (4-2) 08-11 (4-1) 11-16 (3-0) 16-18 (3-2) 18-20 (4-3) 20-23 (4) 23-02 (3-4) 02-05 (2-3) 05-07 (3)	07-08 (2-1) 08-11 (1-0) 11-16 (0) 16-18 (2-1) 18-20 (3-2) 20-02 (4) 02-05 (3) 05-07 (3-2)	07-08 (1-0) 08-16 (0) 16-18 (1-0) 18-20 (2-1) 20-22 (4-2) 22-02 (4-3) 02-05 (3-2) 05-07 (2-1)
160	05-07 (4-2) 07-09 (3-1) 09-17 (2-0) 17-19 (3-1) 19-20 (4-2) 20-05 (4)	05-06 (2-1) 06-07 (2-0) 07-09 (1-0) 09-17 (0) 17-19 (1-0) 19-20 (2) 20-22 (4-3)	05-06 (1) 06-10 (0) 19-20 (2-1) 20-22 (3-2) 22-03 (4-3) 03-05 (3-2)	05-06 (1-0) 06-19 (0) 19-20 (1-0) 20-22 (2) 22-03 (3-2) 03-05 (2-1)

ALASKA

Openings Given in GMT†

To:	10 Meters	15 Meters	20 Meters	40/80 Meters
Eastern USA	20-22 (1) 22-00 (2) 00-01 (1)	18-20 (1) 20-22 (2) 22-00 (3) 00-01 (2) 01-02 (1)	13-15 (1) 20-22 (1) 22-01 (2) 01-03 (3) 03-04 (2) 04-06 (1)	06-13 (1) 07-12 (1)*
Central USA	20-23 (1) 23-01 (2) 01-02 (1)	18-20 (1) 20-23 (2) 23-01 (3) 01-02 (2) 02-03 (1)	14-16 (1) 21-00 (1) 00-02 (2) 02-04 (3) 04-05 (2) 05-07 (1)	07-14 (1) 08-12 (1)*
Western USA	20-23 (1) 23-00 (2) 00-02 (3) 02-03 (2) 03-04 (1)	18-20 (1) 20-22 (2) 22-00 (3) 00-02 (4) 02-03 (3) 03-04 (2) 04-06 (1)	16-19 (1) 19-00 (2) 00-02 (3) 02-04 (4) 04-05 (3) 05-06 (2) 06-09 (1)	07-09 (1) 09-12 (2) 12-14 (1) 09-10 (1)* 10-12 (2)* 12-13 (1)*

HAWAII

Openings Given in Hawaiian Standard Time‡

To:	10 Meters	15 Meters	20 Meters	40/80 Meters
Eastern USA	08-10 (1) 10-11 (2) 11-13 (3) 13-15 (2) 15-16 (1)	06-07 (1) 07-08 (2) 08-12 (1) 12-14 (2) 14-16 (3) 16-18 (2) 18-20 (1)	12-14 (1) 14-16 (2) 16-17 (3) 17-19 (4) 19-22 (3) 22-04 (2) 04-06 (3) 06-07 (2) 07-08 (1)	18-20 (1) 20-22 (2) 22-00 (3) 00-02 (2) 02-03 (1) 20-22 (1)* 22-01 (2)* 01-02 (1)*
Central USA	08-10 (1) 10-11 (2) 11-14 (3) 14-16 (2) 16-17 (1)	06-07 (1) 07-09 (3) 09-12 (2) 12-13 (3) 13-16 (4) 16-17 (3) 17-19 (2) 19-20 (1)	09-13 (1) 13-15 (2) 15-17 (3) 17-20 (4) 20-23 (3) 23-05 (2) 05-07 (3) 07-09 (2)	19-20 (1) 20-22 (2) 22-02 (3) 02-04 (2) 04-06 (1) 20-23 (1)* 23-03 (2)* 03-04 (1)*
Western USA	08-09 (1) 09-11 (2) 11-15 (3) 15-17 (2) 17-19 (1)	06-07 (1) 07-09 (2) 09-11 (4) 11-14 (3) 14-17 (4) 17-19 (3) 19-20 (2) 20-22 (1)	15-17 (3) 17-20 (4) 20-23 (3) 23-02 (2) 02-04 (1) 04-06 (2) 06-08 (4) 08-10 (3) 10-15 (2)	18-19 (1) 19-21 (2) 21-22 (3) 22-03 (4) 03-05 (3) 05-06 (1) 21-22 (1)* 22-23 (2)* 23-04 (3)* 04-05 (2)* 05-06 (1)*

*Indicates predicted 80 Meter openings. Openings on 160 Meters are also likely to occur during those times when 80 Meter openings are shown with a forecast rating of (2) or higher.

†To convert to Local Standard Time in Alaska, *subtract* 8 hours from GMT in the Pacific Standard Time Zones; 9 hours in the Yukon Zone; and 10 hours in the Alaskan Standard Time Zone. In other USA Time Zones subtract 5 hours from GMT in the EST Zone; 6 hours in the CST Zone and 7 hours in the MST Zone. For example, at 20 GMT it is 12 Noon in Juneau and 15 or 3 P.M. in N.Y.C.

‡To convert from HST shown in the Chart to Local Standard Time in other USA Time Zones, *add* 2 hours in the PST Zone, 3 hours in the MST Zone; 4 hours in the CST Zone; and 5 hours in the EST Zone. Add 10 hours to convert from HST to GMT. For example, when it is 12 Noon in Honolulu, it is 14 or 2 P.M. in Los Angeles; 17 or 5 P.M. in Washington, D.C.; and 22 GMT.

Q AND A

BY WILFRED M. SCHERER.* W2AEF

Receiver Blocking With Q-Multiplier

Question: I have a Lafayette HA-350 receiver to which I have added a *Q*-multiplier for c.w. operation. With the *Q*-multiplier set for peaking, and connected to the plate of an i.f. amplifier, the receiver blocks. Why, and what can I do to make the *Q*-multiplier work correctly?

Answer: The blocking may be due to the *Q*-multiplier oscillating. The strong signal thus generated enters the i.f. amplifier and actuates the a.v.c. system which desensitizes the receiver. Try reducing the setting of the regeneration or selectivity control to a point just below oscillation.

Also, the *Q*-multiplier should be connected across the plate or collector of the mixer in a receiver, rather than the i.f.

ITV on National NC-155

Question: I get a considerable amount of interference from television receivers (ITV) on the 80 and 40 meter bands with my NC-155 receiver, but none on the other bands. Using the 600 cycle selectivity position on 40 meters improves the condition though. The interference is not from my own TV set, but there are 48 apartments in the building. I am forced to use a 22 foot restricted space antenna. Is there any help for the ITV?

Answer: The ITV is due to harmonics of the 15750 cycle horizontal oscillator in all TV sets. There is little that can be done to eliminate the ITV under the circumstances, unless the signals are coming in through the front end and overloading the receiver. This is not likely, but could be helped by installing a high pass filter cutting off at 3.5 mc at the receiver antenna terminals. The only other remedy (probably not practical in your particular QTH) is to locate the offending TV sets and apply corrective measures to the sets themselves in the form of line filters, shielding, etc. A line filter at your own receiver might help if the ITV is still present when the antenna is disconnected.

TV receivers are supposed to conform to certain maximum standards of radiation, according to FCC Rules and Regulations, so a call to the local FCC Field Engineer might bring some advice.

Reduction of the ITV using the high-selectivity position on the NC-155 is predictable since with the sharp selectivity comes loss of i.f. sensitivity. This, in addition to the lower front end sensitivity on 40 meters than on 80, probably combines to produce less apparent ITV. The overall sensitivity of most moderate-priced receivers decreases as the frequency increases.

Drift in Collins 75A-4

Question: I have a 75A-4, serial number 3855. Some time ago, it began to be unstable in frequency. From a cold start it will gradually drift down 3 to 4 kc in 5 minutes, then over an hour drift back up to nearly original value. It will wander around slightly so that one has to retune very frequently.

If you know anything about this type of trouble, I will surely appreciate knowing about it.

Answer: If this occurs on all bands, it is probably due to the v.f.o. It may be caused by a defective component thereat, such as padding or temperature compensating capacitors, a bad tube, poor socket contacts resulting in changing heater voltage or poor B+ voltage regulation. The trouble also could be at the mixer to which the v.f.o. is fed, as this might change the load on the v.f.o.

Apparent Sensitivity on SB-301

Question: I have a problem with my SB-301 when it comes to apparent sensitivity. I called Heath and they advised a complete realignment which was accomplished. However, this does not seem to improve the case. At high signal levels, all appears fine, but at low signal levels - lousy. Heath can offer no further assistance. Can you help?

Answer: Both the SB-300 and SB-301 do not usually push the S-meter with low level signals, requiring about 100 uv for S9 (some-

[continued on page 126]

*Technical Director, *CQ*.

THE awards PROGRAM

BY ED HOPPER,* W2GT

Special Honor Roll
All 3079 Counties!

#48—Larry R. Bromstead, W4GGU, 11-18-70.

THE March, "Story of the Month", about Cleo Mahoney, WAØSHE after this data.

Larry Bromstead, W4GGU made *all counties* and found time to apply for All A3A.

Jack duBois, K2CPR stopped chasing DX on all bands to catch up on his paper work and acquired USA-CA-1000, 1500, 2000, 2500 and 3000.

Corwin Arndt, WAØLRQ (see Story/Foto August '68 *CQ*), made it 3000 All A3A.

Roy C. Needham, ZL1KG (see Story/Foto December '70 *CQ*) keeps on climbing and made it 3000, All Fone.

Although it is difficult for anyone to get the necessary QSLs, and ten times harder for s.w.ls, James McFadden, WPE2OKV made USA-CA-500 through 2500, endorsed All Fone.

A nice surprise to hear from Carmen Nieto, YS2CEN who was issued USA-CA-500, 1000 and 1500, endorsed All 14 mc 2 × SSB Mobiles.

Jacob Siegel, K2JVX won USA-CA-500 and 1000 endorsed All 14 mc 2 × SSB.

Glad to hear from an old friend, John Stratfull, exVP2KR, now on Mauritius as 3B8CV, he sent for USA-CA-500-Mixed.

Mixed 500 awards also went to: J.K. Francher, Jr., W5WEE; Norman Russell, W8GBH; Bruce Barnard, ZL1AJU; and John Moulder, WAØPRS.

All A-1 500 awards were sent to: Dick Randall, K6ARE (ex KA7DR, K1GCX) and Shigeru Haga, JA1ACA (#4 to an Asian station).

Jack Slocum, WB2FXK applied for USA-CA-500 endorsed All 7 mc A-1.

Loren McGinnis, WAØJCE acquired a 500 award endorsed All A3A.

Edward Gregan, K1ZSI was issued a 500 award endorsed All 14 mc A3A Mobiles.

*103 Whittman St., Rochelle Park, N.J. 07662.

USA-CA HONOR ROLL

3000		1500			
K2CPR	60	K2CPR	151	WB2FXK	822
WAØLRQ	61	WPE2OKV	152	WAØPRS	823
ZL1KG	62	YS2CEN	153	W8GBH	824
2500		**1000**		WPE2OKV	825
K2CPR	95	K2CPR	221	ZL1AJU	826
WPE2OKV	96	WPE2OKV	222	WAØJCE	827
2000		YS2CEN	223	K1ZSI	828
K2CPR	121	K2JVX	224	W5WEE	829
WPE2OKV	122	**500**		JA1ACA	830
		3B8CV/		YS2CEN	831
		VP2KR	821	K2JVX	832
				K6ARE	833

Cleo J. Mahoney, WAØSHE.

Like all our female County Hunters, being busy with so many jobs to help other County Hunters, I doubt that I'll have space to tell even half the wonderful things about Cleo, but I'll try.

Being a woman, I can not tell you the year, but her birthday is September 6th.

Her many accomplishments include: teaching Physical Education in Jr. and Sr. High School for a couple years, in the ministry work as a writer, insurance work and then into restaurant work. Sold that after about six years and then some seven years with the Water Company of Jackson County, Missouri. Oh yes, also some modeling work and teaching piano.

An interest in amateur radio started as an s.w.l. about four years ago. Shortly Cleo joined

Cleo, WAØSHE at Mike, Don, WAØJRZ at the Log.

Cleo, WAØSHE as a brunett.

the code classes at the Jayhawk ARS. One week later she won the grand prize at their hamfest and went home with a linear, s.w.r. bridge and filter. This equipment looked out of place on the desk with the CB rig, so the next couple of months all spare time was spent on code and soon the wonderful call letters—WNØSHE—became a reality. Then with the constant help of Joe, WAØPJX, time was spent on more code and theory and Cleo followed Joe by one month in obtaining her General License. Naturally her first QSO was with Joe and the great thrill was the next QSO, with DL4AJ. This second QSO had been pre-arranged by a friend, all unknown to Cleo.

One Sunday morning, Cleo received the sad news of her sons apparent blindness while serving near Vietnam in the Navy. This news was received via amateur radio from a little girl in the Phillippines that Cleo had previously contacted. Her son had been able to contact this girl from the hospital in the Philippines.

This started Cleo in her wonderful and dedicated work with blind children.

Her son (22) is now home, does have sight and is married and Cleo hopes for some grandchildren in the not-too-distant future.

In addition to amateur radio and county hunting, Cleo enjoys boating, sewing and crossword puzzles. Until a car accident some years ago, Cleo spent many hours at swimming, tennis, golfing and dancing, unfortunately after the accident, these activities had to be curtailed.

A few of the many things keeping her busy are: QSL manager for W6JHV and K8DCR; custodian for 303 Award; Secretary for the Mobile Amateur Radio Awards Club, Inc. (MARAC) (Awards data was in January '71 *CQ*) and now Secretary/Treasurer for the coming *BIG* Independent County Hunters Convention in Kansas City.

Although living alone, Cleo is never alone. The rig is turned-on the minute on entering home or the car and she always hears someone on that she feels at home with—Yes, alone she never is! One New Years Eve, while attending a party at the home of WAØLIW, they all spent four or five hours on the air with W4YWX, thus Paul was one of the county hunters she was most anxious to meet. The big thrill of meeting Paul took place in Mountain Home, Arkansas July 4th weekend 1969 (Foto/Story page 69 of October '69 *CQ*). Since that time, Cleo has had the pleasure of meeting so very many county hunters that she has worked, and each one has been almost as big a thrill as the first meeting with Paul.

Cleo and Ella, WØAYL have had some real experiences traveling about to give out counties. They will never forget their South Dakota trip with no snow tires and no heater, going through that blinding snow storm.

Our records show that somehow she found time to get her paper work together and on April 15, 1970 was issued USA-CA-500—#783 endorsed All A3A, All 3.9, All 14 mc. Same date USA-CA-1000 #202 and 1500 #136 endorsed All 14 mc A3A. Also same date USA-CA-2000—#105 and 2500 #72 endorsed All A3A. On September 24, 1970 USA-CA-3000—#53 All A3A was issued and on October 12, 1970 All Counties #42, All A3A was won.

Cleo wishes to fully express her thanks to *All* who assisted her along the way and hopes to meet all someday to thank them in person.

We County Hunters are indeed fortunate to have so many fine YLs/XYLs who are willing to, and some how find the time to, be of such great service to County Hunters and Amateur Radio in general, God bless them.

Awards

Worked All Rockland County Award: This WARC award is sponsored by the Spring Valley Senior High School Amateur Radio Club, WB2OOU, and is available to all radio amateurs and s.w.ls the world over. The initial certificate is issued for achieving five confirmed points, one point for each Rockland County, N.Y. QSO or reception, add one point if the contact is a member of SVSHSARC. General Certification Rules —have a radio club officer, notary public or two other amateurs certify that you are in possession of the required QSL credits. Award may be repeated 2nd, 3rd., etc., times with new contacts. Endorsements are available for band, mode, etc. The initial cost of the award is $1.00 U.S. or 10 IRCs DX. Endorsements for additional points cost 10¢ U.S. or 2 IRCs DX. Award is free to blind or paralyzed. Rockland County's a.m. Broadcast stations, WRKL, 910 kc and WKQW, 1300 kc are each worth one point. Award Classes are: E—5 points; D—10; C—15; B—20 and A—25 points. Among the club members are: WA2DGD, WA2FBI, WA2FIQ, WA2FOS, WB2JIC, WB2OZC, WN2PGS. The club station, WB2OOU is worth 3 points. Applications should contain date, time, frequency band, call of station, his QTH, your QTH, and both RSTs (only 1 for s.w.l.). Send applications or

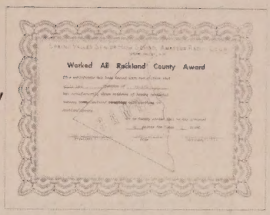
requests for any additional data to WARC Award Custodians: Martin Shulman, WA2FBI, 6 Howard Drive, Spring Valley, N.Y. 10977 or Steven Mates, WA2FIIQ, 112 W. Eckerson Road, Apt. C., Spring Valley, N.Y. 10977.

Nasty Old Man Certificate: Do not let the name confuse you, it is a clever idea and for a very worthy cause. The idea belongs to Grandma Lou, WØCCD and is sponsored by a group of nice young men, The Saint Michael Abbey of Elkhorn, Nebraska. These young men are familiar with the work that Lou, WØCCD has done for children all over the world and desire to sponsor this award. Requirements are to work at least 5 "Nasty Old Men", each in a different state. Send list of their calls, names and states worked to Father Joseph Peters, O. S. B., C/O Mount Michael Abby, Elkhorn, Nebraska 68022. Cost of the award is $1.00 with all proceeds going to the Abbey to help some boy through school. Some of the "Nasty Old Men" are: K1ZFE, Conn.; WA1EXN, Maine; K1FJY, Mass.; K1HFK, N.H.; WA1KZZ, R.I.; K1GYT, Vt.; WB2OBD, N.J.; WB2MXT, N.Y.; K3YKC, Wash., D.C.; K3HFV, Md.; W3GOA, Pa.; K4WHZ, Ala.; WA4MHS, Fla.; W4BCL, Ga.; W4ULE, N.C.; K4GWY, S.C.; WB4KUO, Va.; WA5VUC, La.; WA5DVV, Miss.; WA5OOP, N.M.; K5AKY, Texas; WA6SQT, Cal.; K7CIN, Ariz.; W7RZY, Mont.; K7ZOK, Nev.; W7ZKL, Utah; W7DVB, Wash.; W7VTB, Wy.; K8OJI, Mich.; K8QLT, Ohio; WB8CVG, W. Va.; WA9YXA, Ind.; W9HXV, Wisc.; WØBRS, Iowa; WAØKSK, Kans.; WØPWR, Minn.; WAØHTP, Mo.; and KØTVD, Neb.

HK5 Certificate: There have been some changes in the rules for this award. QSOs after January 1957 are valid; all bands, all modes, but no cross/band/mode, only a certified log need be sent and there is no charge. Colombian stations must have 20 contacts; all other North and South American stations need 12 contacts and all other stations are required to have 8 contacts. Send data to Ana Elisa de Ramirez, HK5AZA, Awards Manager, LCDR, Apartado Aereo 6149, Cali, Colombia, South America.

The Jerusalem Award: All data on this and foto were in March 1970 *CQ*. Submit proof of 2 way radio contact with 7 amateurs in Israel, at least 2 of them located in Jerusalem. Contacts from May 15, 1948. Send log extracts certified by one amateur and 2 IRCs. Unfortunately applicants seem to expect the award via air mail—if you desire award by air mail send $1.00 (or ten IRCs) to O. E. Schremer, 4X4SO, 21 Hapisgah St., Jerusalem, Israel.

The Cosmophone Club Award: In an attempt to locate all previous and current owners of Cosmophone 35, 50 or 1000; Dave Bell, W6BVN and Bob Carlson, K6VOI are offering this certificate. The requirements are: #1—The fact that the applicant is/or was a proud owner of a Cosmophone 35, 50 or 1000. #2—The serial number of such antique gear. #3—His/Her name, call and address. Send this data to: Bob Carlson, K6VOI, 1309 East Elgenia Ave., West Covina, California 91790. (I would like to make 2 observations—#1. The only trouble with the Cosmophone transceiver was that it was *years* ahead of its time. #2. I knew *several* owners but do not know if they still own them. Ed.).



Worked All Rockland County Award.

Diploma of The French Americas: This DAF award is issued for the required contacts made since January 1, 1966, and any amateur band or mode counts. For applicants located in Africa, Europe, North and South America, a minimum of the following is needed: 2 QSOs with FP8, 2 QSOs with FG7, 2 QSOs with FY7 and 1 QSO with either FS7 or FM7. For those located in Asia and Oceania, only 1 QSO per country is required. Send GCR list (log data) to: Alex Desmeules, VE2AFC, P.O. Box 382, Quebec 4, Quebec, Canada.

Notes

On November 25, 1970, Win Tames, WA2QNW and his XYL were again hosts to a group of County Hunters. Special guests were Skip, WAØWOB and XYL, who gave us some interesting data/experiences on their many trips and much information on the *BIG* ICHN Convention to be held in K.C. Other guests included: WA2AMM, W2BLM, K2CPR & XYL, WB2CUI, W2EQK, WB2FVO, W2GT, WA2IRN, W2KXL, W2OST (All Counties), WB2SJQ (All Counties), W2TND and WB2WZE.

Mentioning WA2AMM reminds me that if

[*Continued on page 115*]

Nasty Old Man Award.

SURPLUS sidelights

BY GORDON ELIOT WHITE*

THERE is one heck of a lot of highly interesting surplus electronics coming out these days, from the National Aeronautics and Space Administration, the military, and a lot of labs that have their Pentagon research contracts cut back. Surplus dealers on both the east and west coasts are flooded with the stuff, which is not being picked up with as much interest as it deserves. The reason I suspect it's too specialized for most amateurs and experimenters. There are no more Command Sets, easily converted to amateur band operation. What we are seeing now is sophisticated telemetry equipment, special test sets, etc.

I have been digging for ideas to use some of the N.A.S.A. equipment which at first glance seems worthless except as parts for the junkbox, and SURPLUS SIDELIGHTS reader John Hutchings has come up with an excellent suggestion—use telemetry demodulators for RTTY. Many of these units are reasonably compact, and offer excellent filters and discriminators for RTTY work. The chief modification is to add a keyer capable of handling the usual 60 ma, 130 volt d.c. Teletype loop circuit.

In many Telemetry systems data is fed from a satellite via a v.h.f. or u.h.f. downlink, carrying many different channels in a data stream. Each parameter to be recorded is sent on its own narrow f.m. frequency, which is mixed with the other data for transmissions to the ground station.

On the ground various types of receivers are used, typically a receiver is employed producing a wide video bandwidth. The output is fed to a bank of discriminators, each tuned to a different frequency, which split off the separate channels and produce a suitable d.c. signal, itself modulated by the information being transmitted. Sharp filters are employed at several points in the system, with a low-pass filter following the discriminator.

The system is rather similar to frequency-division multiplex, long used for land-line TTY and data transmission. As I noted in an earlier column, such frequency-division MUX systems can be used for RTTY demodulators by tuning their filters to standard amateur RTTY tones (2125 and 2975 for 850 c.p.s. shift or 2125–2295 c.p.s. for 170 cycle narrow shift)[1]. Fig. 1 shows a telemetry system discriminator, the Electro-Mechanical Research Company Model 97, which is tuneable over a range of from 300 cycles to 10 kc, center frequency.

The telemetry gear offers rather better discriminator characteristics than the FCC-3 and other older multiplex gear, reflecting the recent advances made in handling poor signal to noise ratios and narrow-channel differentiation required in space communications.

Fig. 2 shows a model variable low-pass filter unit, which when used together with the discriminator, can give almost ideal demodulator characteristics for RTTY. Fig. 4 shows a block diagram of the discriminator and the low-pass filter hookup. You need only a keyer, for example the driver circuit of the well-known TT/L-2 amateur demod, as shown in fig. 3.

*5716 N. King's Hgwy., Alexandria, Vir. 22303.

[1]Surplus Sidelights, *CQ*, April, May, 1968.

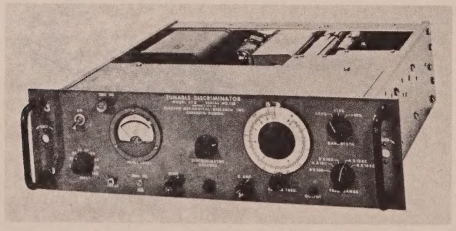


Fig. 1—Tunable audio discriminator, used in N.A.S.A. Telemetry reception, makes an excellent RTTY discriminator when coupled with other surplus gear and a simple loop keyer.

Fig. 2—Variable low-pass filter, following the tunable discriminator (fig. 1) makes a good amateur RTTY receiving setup.

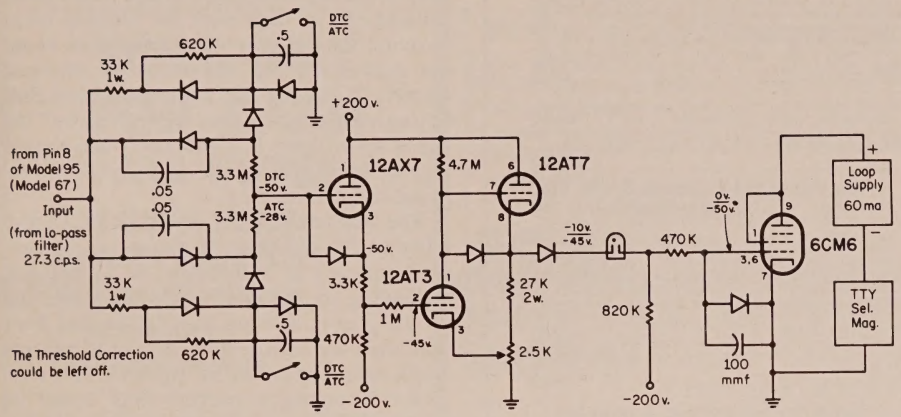


Fig. 3—The decision threshold computer and keyer from the Amateur TTL/2 demodulator can be coupled to the N.A.S.A. telemetry gear to make up a complete demodulator.

This setup will limit a 10 millivolt signal over a dynamic range of 30 db. Linearity over the full bandwidth is better than 0.1%. Capture ratio John says, is such that a co-channel subcarrier can be as great as 90 percent of the desired subcarrier without causing interference.

Actually the Electro-Mechanical Research 97G unit was probably used by N.A.S.A. or its contractors in designing telemetry systems, rather than as an operational demod. The 67D subcarrier discriminator is more common in space surplus. This is also a rack-mount unit, about five inches high, with plug-in filters. The 67D combines the functions of the variable units, while still allowing a certain flexibility in channel selection by the use of replaceable filter units. Separate plug-ins allow selection of different center frequencies and low-pass output values. The

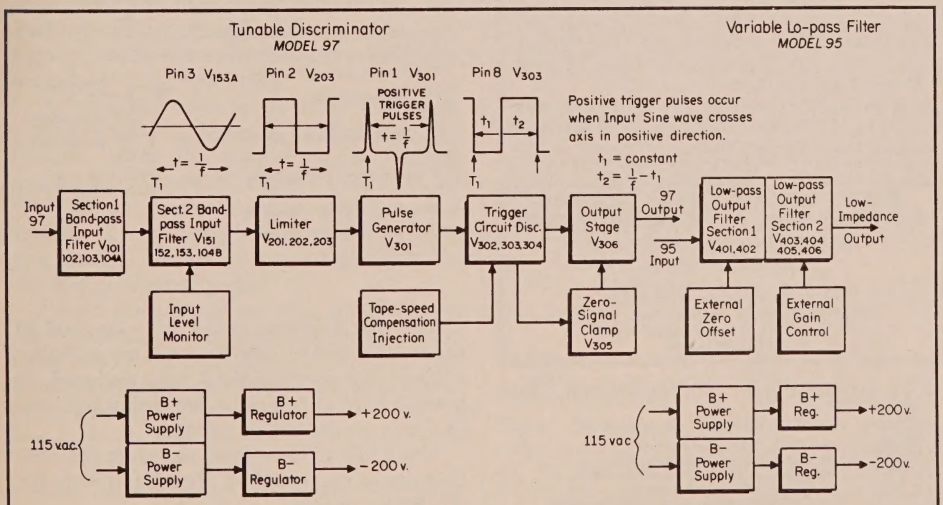


Fig. 4—Block diagram of the N.A.S.A. units used as an RTTY terminal unit.

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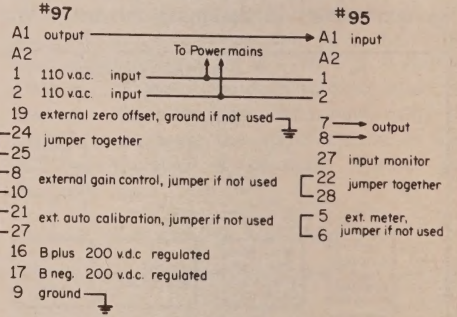
2,300 c.p.s. channel filter would be roughly correct for standard RTTY work, particularly in the high-frequency bands where some shifting can be done with the receiver b.f.o. to center the signal in the discriminator channel. Actually, center frequency for standard tones is 2525 c.p.s. For audio frequency shift keying where there is no way to "move" the signal up or down in frequency when receiving, the filters would have to be modified—retuned to hit 2525 c.p.s.

The characteristics of the EMR filters give a bandwidth of either 7.5 percent of the center frequency at 3 db down, or 15 percent, depending on the filter used—this is marked on the plug-in section. The 7.5 percent filter is all right for narrow shift, but the 15 percent width would be better for standard 850 wide shift. Of course a narrow filter could be loaded with resistors to broaden its response. Some experimentation is in order there.

The low-pass sections are available in several values, most of them usable as-is for RTTY. This one should have a cutoff of at least 27 c.p.s. to handle 60 word per minute Teletype which has a dot-cycle rate of up to 22.8 c.p.s. For faster speeds the low pass filter may be correspondingly higher, *i.e.* about 37 c.p.s. for 100 w.p.m. transmissions, used these days by the M.A.R.S. boys.

Interconnections for the Model 95 and the Model 97 are as follows:



The 200 volt d.c. power may be used to supply B+ to the loop keyer. This is higher voltage than the TT-L/2 was designed to operate on, but John says the circuit operates perfectly on the higher voltage.

The EMR 67D unit has the same pin connections as the model 95. Pins 8 and 9 are the d.c. keyed output.

On the 67D, the PUSH TO ADJUST pot

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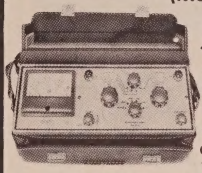

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grounds the output amplifier so that the output amplifier may be zero balanced without regard to input inbalance. The pot on the filter may be used to trim the center frequency slightly.

I haywired together a rig using the 67D which seemed to work fine on a brief test. John, who has used it extensively, says the performance is fantastic. "I have truly copied signals I could barely distinguish in this high-noise level area," he writes.

A few other notes on the 67D: you might want to load the input with a 600 ohm 2-watt resistor. Since the output swings plus or minus 100 volts d.c., which is fine for the TT/L-2, but might be rather wide for other simpler keyers, it might be necessary to add in a voltage divider on the output to reduce the shift to a smaller value.

I have not yet thrown out my Frederick 1203 demod, but John advises me that he is using a 67D instead of his ST-6 or CV-89 demods. He says the EMR unit gives better performance. ■

USA-CA [*from page 111*]

you ever hope to get a QSL from the mobiles or other stations who work hundreds of County Hunters, you better use the type of QSL that *YOU* can completely fill-in and address it to yourself with a stamp on it, so the station you send it to can easily check it against his log, sign it and drop in any mail box. Such QSL cards are sold at 500 cards for $4.00 postpaid (add 25¢ if you are west of the Mississippi River) by John J. Brenner, WA2AMM, 162 Meisel Ave., Springfield, N.J. 07081. Also remember he may need a QSL from *YOUR* county, so be sure to send along one of your QSLs.

Ambrose G. Barry (Capt. U.S.A.F.), W4GHV, formerly at the Cape at WB4ICJ, complains of lack of QSLs from fellows who work W4GHV/M. Yes, he also needs QSLs for USA-CA. His present QTH is 538 E. Samford Ave., Auburn, Alabama 36830.

Edmond Dubois, F9IL (DUF Award Mgr.) is also trying hard to collect QSLs for USA-CA and now K9BJM is his QSL manager.

A note from OK1-15835 and Karel also has QSL problems. Since 1966 he has sent over 2500 QSLs to US stations but has less than 600 replies and needs more to make USA-CA.

Being a proud member of the Amateur Radio Editors Association (get data on AREA from Harry Tummonds, W8BAH) I do have the opportunity to review many of the fine books put out by Tab Books, Blue Ridge Summit, Pa. 17214. They have a wide selection of books on all phases of the electronic field and may I sug-

gest you write them for their latest catalogue.

That unsigned letter from Italy regarding WAZ has been turned over to John Attaway, K4IIF who takes care of WAZ.

Please excuse me, have been so darn busy have had little time to check into the ICHN and I miss it—How was your month? 73, Ed., W2GT.

CQ Reviews: LEL [*from page 87*]

least one branch of the military, as it is understood that the manufacturer has supplied such to the U.S. Navy. We, too, have already found occasion for employing our model to advantage in servicing amateur equipment.

The LEL Dynamic Serviset Model E-C is priced at $24.95, complete with all accessories and carrying pouch. For further details and a more complete description of its usefulness, it is suggested that a line be dropped to the manufacturer: Lee Electronic Labs., 88 Evans Street, Watertown, Mass. 02172.

—W2AEF

---

500 W. on 2-Meter [*from page 20*]

TX-62 as the exciter worked very well for us. It has not proven necessary to "ride gain" on the audio level when changing the drive to the linear. With varied settings on the TX-62 drive control we are able to set the linear output anywhere between 13 to 130 watts. There is no loss in the quality of the transmited signal at any power level; our linear is truly linear.

There are unfavorable reports when high audio level settings are used. This is particularly so with contacts at 80 miles or less. Those 130 miles or more find the signal good. ■

---

2 M. Antenna Array [*from page 56*]

improvement is immediately apparent compared to the simple parallel connection. Small coax is used, in odd quarter wave sections, and RCA phono plugs and jacks can be used for the multiple connections, instead of splices, provided the jacks are mounted as close as possible and connected by *very short leads.*

Pruning, Tuning and Adjustment

Data is given for a two and four dipole array, and can, with careful workmanship, be used without tuneup. S.w.r. will be 1.3 to 1 or less. However, if tuneup is felt necessary, the procedure is simple. All dipoles are mounted and adjusted to 0.22 wave-length center to center from the mast, and the whole assembly set up about 5 feet from the ground, with the dipoles aimed straight up. A 50 ohm line is temporarily connected to the top dipole *through* the support arm. Starting with the dipoles an inch too long, 1/8″ is pruned from each end and the s.w.r. checked. This is continued until no further reduction in s.w.r. is obtained. The mast to dipole spacing is then adjusted for lowest possible s.w.r. With this done, the 50 ohm cable is disconnected, and all dipoles set up and pruned to be absolutely identical with the one just tuned up. The matching harness is installed, connected to the line, and the system is ready to go.

NOTE: When there is any significant change in s.w.r. when pruning, the signal source output link tuning should be peaked up, as the line reactance diminishes when optimum adjustment is approached. Otherwise s.w.r. readings will not be accurate.

Performance

The system described is right out of the book, with all attributes and parameters optimized. Gain figures are not referenced to an isotropic radiator, but to the more realistic quarter wave ground plane. Gain figures are honest and are minimums. A complete mathematical treatment might show slightly higher values.

Performance of both two and four element versions has been superb. The design is completely repeatable, and the only requirement is good workmanship, especially with connections and splices.

Day to day consistent working range is five to six times better than the ubiquitious ground plane, and band openings bring in four and five call areas to the hilly terrain of southeastern Wisconsin. The 2.8 db difference between front and back that exists on paper has not shown up in actual operation. The antenna has been oriented in three directions 120° apart with no apparent change in a test signal 50 miles away. However, if it exists on paper, it exists in fact, and the antenna should be aimed toward the marginal signals if they can be improved by so doing.

Using one inch diameter dipole elements, the s.w.r. is essentially constant over the entire 2 meter band, rising to 1.5 at 150.09 mc. At 175 mc., s.w.r. was 2.1:1. The system will handle a full gallon, if RG-11/U is used for matching sections, and RG-8/U for the line.

[*Continued on page 118*]

Sylvia [*from page 48*]

Then came the families, out for the day with picnics; lads with their lasses, boys dressed as gaily as girls these days, *vive Unisex!* Old ladies in hats and gloves; thousands of foreign tourists, bless 'em; earnest Germans with guide-books; wide-eyed Americans; silent, watchful Iron Curtain visitors; possessive British Commonwealth visitors, proud of their heritage; gaudy orientals; expensively-dressed Japanese, and all clicking cameras like silly, Tourism is Britain's 3rd biggest industry now, and her life-blood. To the tourists GB3SUA was part of the quaint old English scene and we were glad to have it that way.

If we worked a country whose nationals were in the crowd, there would be a little, electric thrill, easy to detect, emanating from those visitors. I did my public relating on the steps of the exhibition station, explaining to the audience what was going on and making a small, deliberate production number every time we called a new country. The audience appreciated the tiny moment of drama—would we hook another country and so be able to put another pin in the station map? What seemed like a permanent group of small boys loitered round the station, keeping the score. I suspect it made a change from collecting car numbers.

Amateur radio visitors from all over the area came to pay their respects and we had some overseas guests, including WA9WNF, Timothy Kearney, from Fort Wayne, Indiana. Tim had been in the audience at the theater, came out onto the balcony in the interval, looked across the river and thought he was dreaming. It was all he could do to sit tight until the end of the play, to get across that river to the other kind of hamming.

When I had been in Norh America, Noel Eaton, VE3CJ, Canadian Director of A.R.R.L. had arranged skeds for GB3SUA with a station in Stratford, Ontario. I mentioned this to John Huntoon, W1LVQ, A.R.R.L. General Manager, when I visited A.R.R.L. Headquarters in Newington. "What about Stratford, Connecticut?" he asked and there and then fixed skeds with Connecticut.

If this were a fairy story, both skeds would have come through, 5/9-plus and everybody would have cheered the Prince as he married the Beggar Girl. But amateur radio—lord love us—is no whimsy, no fantasy, rather a science, a cold reality, a sophisticated tech-

A river carnival, with the ugly Royal Shakespeare Theater in the background.

nology, calculable, computerable, a matter of data and statistics, nuts and bolts, capacitors, transistors, resistors, ohms, watts, amps, joules, henrys and megahertzes. *In a pig's eye.* The science of amateur radio is, when it comes to the crunch, as unreliable, incalculable, feckless, fickle, whimsical and cussed as any once-upon-a-time and lived-happily-ever-after. You think you know it all, you radio amateurs, so superior with your Extra Class Licenses and your amateur satellites, with your f.e.t.'s and your Moonbounce. So would one of you explain to me, please why the sked with Connecticut worked and the sked with Ontario didn't? Why, with all three Stratford's on the beam, didn't we hook Ontario? Silly little woman's question, I know, irritating and beneath your dignity to answer but, please, WHY?

I answered questions, referred the technical ones, which are dull anyway, to whichever hapless amateur happened to be standing around. I kept the children's sticky fingers off the knobs and kept the dogs away from the pots of Parks Committee plants. I fed the operators, flattered the Press, entertained the B.B.C. (who had the most beautiful blue eyes I've ever seen in a man), signed autographs. I had a wonderful time. But at no time was I more than a corollary to the *status quo,* for GB3SUA was a public relations project promoted entirely by local radio amateurs. Madison Avenue couldn't have done better. Nor could I, except for one incident.

I explained to the public, again and again, every hour on the hour, how GB3SUA was there to celebrate 700 years *etcetera etcetera.* And when, towards the end of the second day, a little wilted, I told a group of eager tourists that GB3SUA was there to celebrate 700 years of amateur radio, nobody even noticed. ■

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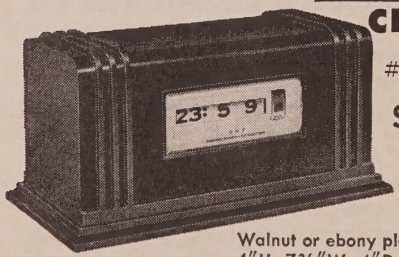

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2 M. Antenna Array [*from page 56*]

Appendix

A. Dipole length = $\frac{5610}{fmc}$ inches at center frequency.

B. Subtract 2% for element length-to-diameter ratio of 100; subtract 3% for length-to-diameter ratio of 50.

C. Calculate matching sections for center frequency:

$$1/4\ \lambda = \frac{2952}{fmc} \times .659$$

D. All dipoles polarized the same, *i.e.*, braid up, conductor down.

E. For matching sections when feed and antenna impedance are known:

$$Z_0 = \sqrt{Z_1 \times Z_2}$$

When feed and matching section impedance are known:

$$Z_2 = \frac{Zo^2}{Z_1}$$

Where:

Z_1 = Input impedance to matching section.
Z_2 = Antenna impedance.
Zo = Matching section impedance.

CQ Reviews Varitronics [*from page 36*]

dually calibrated to the receiver the markings on the discriminator meter should be used only for relative readings.

Evaluation

The Varitronics-Inoue IC-2F/IC-3P combination and the IC-2F alone meet the manufacturer's specifications. Construction and workmanship are excellent. The six channel combinations are satisfactory for most amateur f.m. work and the power output is satisfactory for all but the most serious f.m. DX'er. The compact size and the interchanging power cables make handling and multi-use (between base and mobile, or between various mobiles) very easy.

The basic Varitronics-Inoue IC-2F including mounting bracket, microphone, crystals for 146.34 mc and 146.94 mc transmit and 146.94 mc receiver, and miscellaneous installation hardware is priced at $349.95. The matching IC-3P a.c. power supply sells for $49.95. Both units are available at many local amateur distributors. The importer is Varitronics Incorporated, 2321 E. University Drive, Phoenix, Arizona 85036. —*K9STH*

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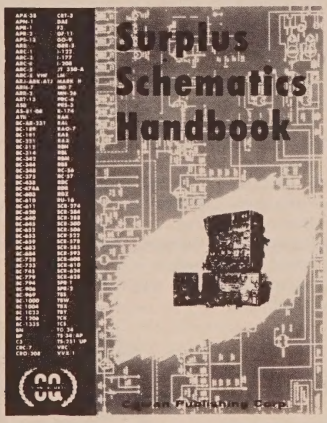

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ARC7	BC610A	SCR274	TBW

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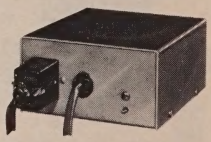

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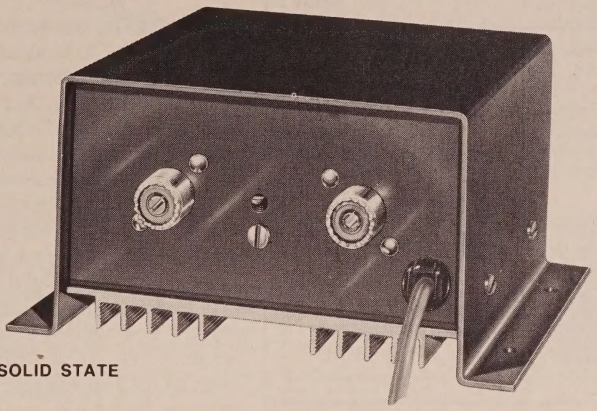

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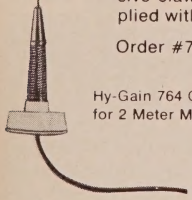

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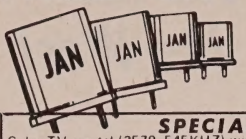

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WWV Converter [*from page 40*]

you a stronger signal from WWV. Now apply +9 volts to the 9.5 mc crystal oscillator and adjust the DRIVER, TUNE and LOAD controls for maximum signal strength or noise. Then adjust the trimmer capacitor on the 9.5 mc crystal oscillator assembly until you hear WWV. Once you have located and definitely identified WWV, zero beat the transceiver to WWV by means of the trimmer.

Adjusting the Calibrator

Now set the transceiver on end and turn on the 100 kc crystal calibrator. Adjust the 100 kc oscillator trimmer so that its harmonic will zero beat with thet WWV signal. (The trimmer is mounted above and to the left of the 100 kc crystal socket terminals on the underside of the chassis. It can be reached through the perforation in the bottom screen with a small screwdriver. Don't try to make this adjustment when the WWV signal is being tone-modulated because you may be zero-beating with a sideband instead of the carrier. You will now have reliable marker signals every 100 kc throughout the tuning range of the transceiver, and you'll be able to get time checks too.

A Word to the Wise

Be sure to remove the +9 volts from the oscillator and replace the 9-pin plug on the back before you resume operations. Failure to remove the +9 volts will give you some unwanted birdies in your receiver. Also, the 9.5 mc oscillator can provide sufficient drive to give you substantial 4 or 15 mc output should you inadvertently tune up on 80 or 20 meters with it connected to the v.f.o. amplifier stage.

The same approach can be applied to other Swan equipment as well as to similar receivers and transceivers of other manufacturers as long as you use a suitable injection frequency and select a WWV frequency which will be accepted by the tuned circuits in your receiver or transceiver. ■

Tuning Diodes [*from page 27*]

"ballooning" of any selected small portion of the tuning scale. The effect is similar to having a dial mechanism with a variable "kc per revolution" action. However, the effect is accomplished completely electrically instead of mechanically. The basic way in which this

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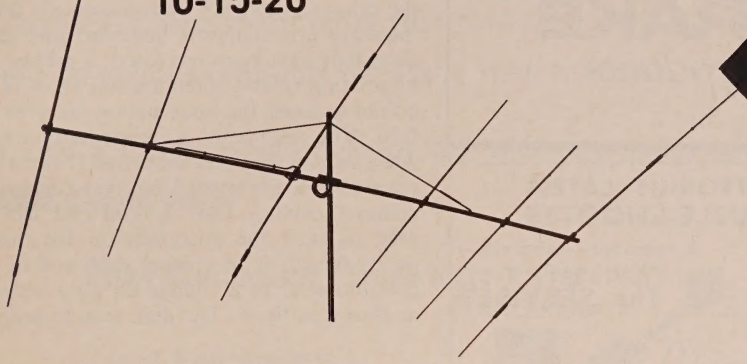

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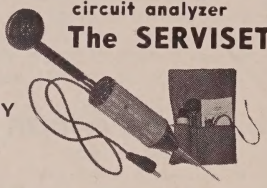

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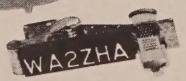

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option may be implemented is illustrated in fig. 6. It is based upon the idea that as long as the wiper arm of the tuning potentiometer remains at the same potential above ground, the capacitance of the tuning diode will not vary even though the potentials to ground at both ends of the fixed resistance portion of the potentiometer are both increased. When the wiper arm is moved, however, after these potentials have been increased, a greater arc of rotation of the potentiometer shaft is required to cover the same tuning range as before. The technique is particularly useful when switching in very selective i.f. filters in a receiver and the overall receiver tuning becomes "touchy." One method that can be used to raise the potentials on the tuning potentiometer is to contact each end of the potentiometer to a voltage dividing network as shown in fig. 6. The dual section potenti-

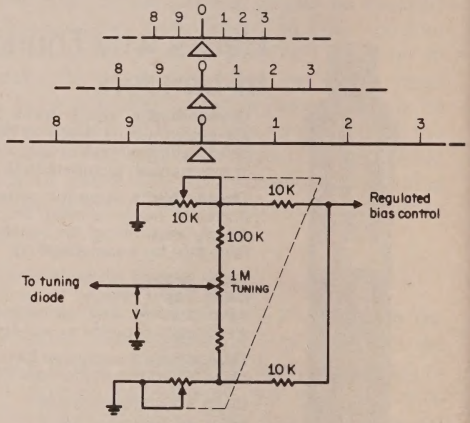

Fig. 6—By using a bias control circuit such that "V" remains constant while the voltage at each end of the tuning potentiometer increases, the circuit controlled by the tuning diode remains tuned to the same frequency but the tuning scale can be "ballooned" as desired.

ometer is wired such that one section increases its resistance as the other section decreases its total resistance. The "magnifying" effect will not be uniform over the entire tuning scale but this is generally no great disadvantage since the technique is designed for improved incremental tuning and it should be disabled whenever accurate dial calibration is desired.

Summary

The use of tuning diodes indeed opens up a multitude of new possibilities for tuning

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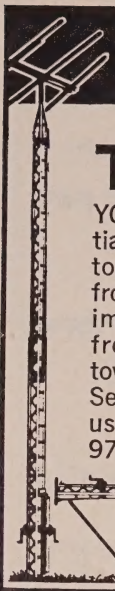

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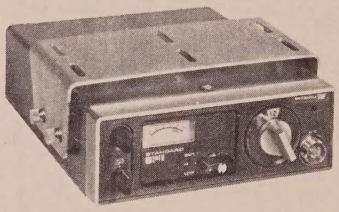

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schemes. If one is replacing an air variable capacitor, a simple diode control circuit should be used first to verify proper diode operation. One can then proceed to other forms of more complex control as expanding the tuning scale, splitting the tuning scale into individually controlled switch-selected sections, "magnifying" the scale, etc. The careful use of a calibrator or signal generator is necessary to resolve the resulting change in dial scale calibration. Certainly if a transmiter v.f.o. is modified, the output frequency for a given setting should be very carefully verified before the transmitter is used. ■

Our Readers Say *[from page 8]*

Better Late Than Never

Editor, *CQ:*

Please find enclosed my WAZ certificate issued November 29, 1951. It arrived without the seal affixed and over the years I've been meaning to send it back to have this done. Now, after nineteen years nearly, I've got around to doing it!

Would you please fix a seal and send it back.

With best wishes for 1971,
Colin Bell, ZL2CU
Gisborne, New Zealand

ZL2CU should have his WAZ certificate back in its place of honor on the shack wall by now. Next time, Colin, try to follow up such problems within the same decade, eh!—Ed.

Q & A *[from page 108]*

what more on fifteen and ten where the gain is lower). However, the overall signal-to-noise ratio remains the same: approximately .25 uv for 10 db S+N/N on s.s.b. The sensitivity just appears lower because of less gain on the high bands and lack of S-meter readings in any case with weaker signals. Lack of good a.g.c. action at the lower signal levels and the limited action at the lower signal levels and the limited dynamic range of the a.g.c. also makes the difference between weak and strong signals seem great.

Besides proper alignment, be sure the v.f.o. and heterodyning oscillator output are correct. Proper size cathode and screen resistors are also important. Check these.

A hotter tube, such as the 6GM6, in the front end may help; however, a hotter tube often invites other troubles such as regeneration or oscillation that may deteriorate the signal-to-noise ratio.

We have no specific information on such a change.

73, Bill, W2AEF

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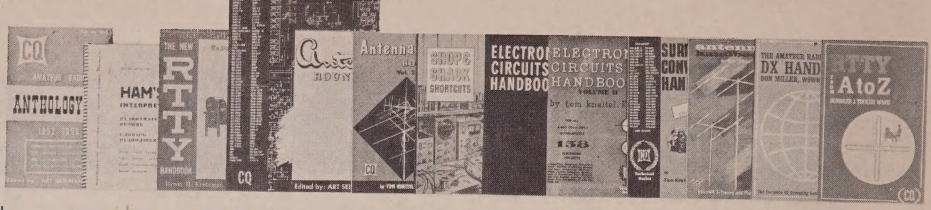

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WANTED: R-61/ARQ-5, R-105/ARR-15, R-44/ARR-5, condition unimportant. E. A. Sjolander, Jr., Box 262, Ashland, Wi. 54806.

SALE: SPRAGUE TEL-OHMIKE capacitor analyzer/turns ratio bridge. $75. Box 797, Bob Fournier, FPO New York. 09555.

SELL: Gonset 101 Linear, CMA Ameca Converter xtals 160-2 New Mars LE-2 Patch, Kwickpatch-Kwp4a, Bw FC-15, 2 new S5130 Silicon Rect'rs. Want Jones Coupler 261.1 & Webster 160 Mtr. coil. W9PIH, 4433 Ft. Wayne, Ind. 46806.

GALAXY V Mk 2 (factory aligned) w/cal. vox, AC-35, DC-35, No. 500, offer. You pay shipping. W0MXE, Oak Grove, Knob Noster, Mo. 65336.

SELL OR TRADE: 150 watt, 80-40-20 homebrew Xmtr., 810 tube, (good for high power modulator), Hallicrafters R-48A Speaker, more. Write: WB2PUH, F. Simon, 26 Joanne Ct., Albany, N. Y. 12209.

AMECO CN50W six meter converter (mint) IF 28 mc, and PS-1 (used/good) $30.00, firm. WA4NED, Box 468, Gainesville, Ga. 30501.

SELL: R-390A receiver excellent to new cond. $795. WANT: GPR-92 and KW Matchbox with coupler. W4AIS, 300 Thornwood, Taylors, S. C. 29687.

WANTED: B & K Television Analyst model 1076 or 77. Reasonable. Write condition, price. Joe Wegner, Jr., P. O. Box 262, Glendale, Calif. 91209.

ASSORTED PANEL METERS, $2.00 each and ppd. Send stamp for listing of tech. books, antiques, misc. gear. G. Samkofsky, 201 Eastern Pkwy., Brooklyn, N. Y. 11238.

WANTED: By Student. B & K Television Analyst and Test Equipment. Reasonable. Joe Wegner, Jr., P. O. Box 262, Glendale, California. 91209.

SELL: Johnson Viking Phone Patch, $15; 4-1000A, $10.00. Blower for tube (4-1000A, 3-1000Z, etc.), $5. WB2YRU, Al Povol, 3538 Centerview Avenue, Wantagh, N. Y. 11793.

LIKE-NEW SB200 Linear $190; SB620 Kit form never unpacked. $100. H. D. Woertendyke, 23 Arbutus Dr., Key West, Fla. 33040.

FOR SALE: Radio Shack DX-150 new condition, $75. Earl Carsner, W0MN, 935 Geary St., San Francisco. Calif. 94109.

FOR SALE: Radio Shack DX-150 communications Receiver, new condx, cost $119.95. Now $75. Want to buy: Drake SPR-4. E. Carsner, 935 Geary, San Francisco, Calif. 94109.

RTTY INFORMATION for the amateur interested in RTTY. F. DeMotte, P. O. B. 6047, Daytona Beach, Fla. 32022.

WANT: DREML MO70 tool in good cond. Trade XMTG tubes, test equip., etc. Samkofsky, 201 Eastern Pkwy., Brooklyn, N. Y. 11238.

WANTED: KW Transmatch or Matchbox w/meter. GR-650A Imp. Bridge. W9CO, 604 Wyatt Ave., Lincoln, Ill. 62656.

WANT TO BUY twoer in Chicago area. Will help take down. Any size, if reasonable. W9GRS, 1421 Maple, Evanston, Il. 60601.

WWV Rec. Gen Micro 550, $50. Strob-Conn 6T4 Piano Organ Tuner, $80. CV253/ALR, 38-1000 mc. $70. J. Murray, 40-33 61st St., Woodside, L. I., New York. 11377.

Retiring to full time trailering in '71. Liquidating 20 years' ham gear. Send SASE for list. WA8FYA Worden, 322 W. Clinton, Jackson, Mi. 49201.

88 Mh toroids, uncased, 5/$1.50; pp 48, E. W. Evans, K4OEN, 220 Mimosa Ln., Paducah, Ky. 42001.

28 RTTY ASR and KSR cabinet for sale or trade. Need Tektronix 315 or 317 scope or will consider other test equipment, D. C. Harrington, 1620 Gardena Ave., Fridley, Minn. 55432.

NEED: Edmund Bearkley Spiral Slide Rule. Can use two. WA8FFZ, Box 228, Wickliffe, Ohio. 44092.

SEND ME ANY AND ALL NEWS ITEMS ABOUT original and copy returned. WA1GFJ, 160 Elm St., North Haven, Ct. 06473.

MECHANICAL FILTERS. 455 Khz, 2.1 Khz, $18.95. 300 Hz, $22.95. J. A. Fredricks, 314 South 13th Avenue, Yakima, Washington. 98902.

SELL: TR44 rotator, A-1 condition. $40.00. WB2YRU, Al Povol, 3538 Centerview Avenue, Wantagh, Long Island, N. Y. 11793.

SALE: RF Sig. Gen. Knight KG-650, $13; AR-22 Rotator, $20; 10V. 10A. Fil. Xformer, $3.50 plus postage. K3FOD, 925 Coleridge Rd., Balto., Maryland. 21229.

HAMMARLUND HQ215 Brand New Solid State Receiver. Must Sell. Cash only. No reasonable offer refused. Colella, 105-18 131st, Richmond Hill, New York. 11419. Phone: 641-2559.

WANTED: Hallicrafters HT32, HT37, HT46 or similar transmitter, will pay cash. Best offer. Also will trade 2 4-150A's for what have you. George Groff, RD2, Pine City, N. Y. 14871.

FOR SALE: Super pro 600 Rack Mount in mint condition. WA2LGJ, Bronx, N. Y. No shipping.

SELL or Trade Electronic parts and equipment; some manuals, H.P.; Tek; NLS and others, garage full. KL7BT/7, Rt. 1, Box 192E, Banks, Ore. 97106.

SELL: Magnecorder 800 series Reversamatic Tape Deck 14" reels, 3 3/4 — 7 1/2 15 IPS, $195. R. Lee, 840 Poinsettia, Titusville, Florida. 32780.

RTTY 28 KSR & ASR Floor Console Cabinet, ASR LIESU, 32 ASR & KSR Stand, BRPE Puch for sale-or trade for 28 equipment. D. C. Harrington, K0SHK, 1620 Gardenia, Fridley, Minnesota. 55432.

WANTED: Mounting table for model 15 RTTY Page Printer. Local deal preferred. WB2JFX, T. A. Fuhrman, 93 West Shore Avenue, Dumont, New Jersey. 07628.

THE OLD OLD TIMERS CLUB desires your membership. If licensed for 40 years, just send your QSL Card to: Chas. W. Boegel, Jr., W0CVU, 1500 Center Point Road, N.E., Cedar Rapids, Iowa. 52402, for application.

WANTED: Low Pass Filter, KW, 52 Ohm, B & W 425, Bud LF601, etc. Details to GRIMM, Box BC Sweet Briar, Virginia. 24595.

FOR SALE: Gonset G-66 and G-77 (professionally designed) w/A.C. Flat power supply. Makes suitcase (CW) station, $110.00. W2CVW, 13 Robert Circle, South Amboy, N. J. 08879.

WANTED: SX-28 rcvr in excellent cond. J. H. Gordon, W5GXH/1, 6 Maple St., Bedford, Ms. 01730.

WANTED: 110V A.C. Generator. Buy or trade ham gear. H. Uthoff, Rt. 1, Box 121, Scottsbluff, Nebraska. 69361.

TRADE: Variable transformer, 220 V in, 0-280V out at 3.5A for 120V unit at 7A. W9AMM, 5973 Sugarbush Ln., Greendale, Wis. 53129.

SWAP: Don Brittons, Howards, Etc. Construction plans. 1 for 1. Joe Wegner, Jr., P. O. Box 262, Glendale, California. 91209.

FOR SALE: LAMPKIN FREQUENCY METER, Type 105-B, S/N 1757, with Eng. Data and Graphs. Make offer. W6DOU, 3154 Stony Point Rd., Santa Rosa, California. 95401.

HELP: Underprivileged novice needs donation of equipment. Must be in working order. WN6FTK, Jim, 1447 W. 171st, Gardena, Ca. 90247.

SALE: 4CX1000 tube and 2 sockets (used), $45. Vacuum variable capacitor w/drive, 23-500 mfd. at 15 KV, UCS-500 (new), $30.00. 1-inch scope w/tube, Millen 90901 (new) $25.00. Bill Doctorman, K6AEZ, 150 Geneive St., Camarillo, Ca. 93010. Phone: (805) 482-4450.

GET YOUR FIRST! Memorize, Study: "1970 Tests-Answers" for FCC First and Second Class License. Plus "Self-Study Ability Test," Proven. $5. COMMAND, Box 26348-F, San Fran., Ca. 94126.

WANTED: SX110,good condition. Advise cost plus express charges your location to Washington, D. C. M. P. Driggs, 4201 Cathedral Ave. N.W., Washington, D. C. 20016.

IGNITION NOISE CURED, simple and guaranteed, write for information to W0BNF, Box 105, Kearney, Nebraska. 68847.

WANT KWM2 or S-Line needing repairs; Describe your gear and price acceptable. W0BNF-, Box 105, Kearney, Nebraska. 68847.

FOR SALE: SB101 with 400 HZ filter, HP23, SB-600, and HDP21A microphone. Excellent condition. $395. WANT: MS-3 and TV-1000 LP filter. WA3EIP, Dennis Quinn, 88 Woodrow Court, Sharon, Pennsylvania. 16146.

DRAFTING SERVICE: For hams, engineers; professionally Inked- Ready for publication. 20 years experience. For information, send SASE. R. Wildman, 8512 Acapulco Way, Number 2 Stockton, California. 95207.

WANTED: Swan 420 VFO. Give serial. B. Carl, K6DPG, 11128 Claire, Northridge, Ca. 91324.

WANTED: AC or DC governed (not Synchronous) motor for model 115 teletype, with mounting base fan, and drive gear for 60 WPM. R. J. Turner, 134 South 11th Ave., Hopewell, Va. 23860.

FOR SALE: 2 meter transceivers, Lafayette HA-144, $85.00. Heath HW-17A, $100.00. Both excellent condx. WB6FDQ, P. O. Box 99111 San Francisco, California. 94109.

MITE TELETYPE: Weight 36 lbs., table top unit, 3 speed gears. Uses standard paper and ribbon. Non-overline, copy lights, built-in loop supply. Very clean condx. $175. Ray Gilbert, K7VQF, 201-130th Ave. S.E., Bellevue, Washington. 98005. Phone: (206) 454-0578.

SERVISET MODEL E—C. Commercial counterpart of our Navy model D—AN. A complete trouble-shooting lab that fits in your pocket. $24.95. PP. 30-day guarantee Free info. WA1HXZ, LEE ELECTRONIC LABS, 88 Evans St., Watertown, Ma. 02172.

QSL's: 100 2-color glossy, $3.75; 100 3-color, $4.75; RUSPRINT, Box 7575, Kansas City, Mo. 64116.

RUBBER ADDRESS STAMPS: $2. Signature, $3.50. Free Catalog. Jackson's, Box 443F, Franklin Park, Illinois. 60131.

HAMS: CB'ers: Club or individual emblems. WE WRITE ANYTHING! Information, RUSSELL, 1109-Turner St., Auburn, Maine. 04210.

LAMPKIN MOD. METER, Quad-Scale, $200; Motorola T43GGV, $100; GE CMC-60B4-H, $175; Both Hi-Band and Exc. Hatfield, Box 607, Dobson, N. C. 27017. Phone: (919) 386-8562.

1896-1922 WIRELESS GEAR, wanted for cash or trade. Dick Sepic, 1945 E. Orangegrove Blvd., Pasadena, California. 91104.

HAMMARLUND HQ-170C, Mint Condition. Make offer. W2EZF, 715 Oak Hill Ave., Endicott, New York. 13760.

FOR SALE OR SWAP: Laboratory Test Equipment—Garage full! Hewlett Packard UHF Signal Generators $25 ea., Oscilloscope, storage type 5" screen (similar to Tecktronix) $250., etc. Stereo equipment: casette recorder/playback units — car and home types. Cameras, etc. Send for list. Murray, Marcus, 11 Eldridge St., East Northport, N. Y. 11731.

POSTAL CHESS: American Postal Chess League, Box 1022, Greeley, Colorado. 80631.

YAESU FRdx 400 Rcvr, FLdx 400 Xmtr, and FLdx 2000 linear. 25 kc Cal, Rejection tuning, CW filters, WWV, etc., etc. Excellent condition - $500. Also SWAN 500 ac/dc supplies - $400. Joe Penwell, WB6YKR, 12728 So. Burgess Ave., La Mirada, Calif. 90638. (213) 691-6743.

SELL: SB200, $150; 75A3, $190. WANT: 75S3C and Ham M. Bill Adams, Box 241, 29 Palms, Calif. 92277.

Mint SR 150, PS 150-120 HT-45, P45, Coax relay cables, complete with books. No scratches. Perfect electrically. Paid $1300. Sell: $550. Certified ceheck, please. K6PUN, FOB 960 10th St., Number 10, Santa Monica, Calif. 90403.

HW 22 and HP 13 for parts. No workee. $56 takes all. Certified check, please. K6PUN, FOB 960 10th Street, number 10, Santa Monica, Calif. 90403.

QSL MANAGER: Will volunteer my services. W7HKI, D. G. Larry Larison, Traveler's Lodge, Edmonds, Washington. 98020.

SELL: RCA type CT-11B 30-50 MHz RF power Amp. Utilizes pair of 4-125A's which are included. Shines like new. $65 or best offer. P. Shaw, 15010 Cordell, Woodbridge, Va. 22191. (703) 670-4900.

FOR SALE: Hammarlund HQ-180, $230; Johnson Viking II, 200 watt AM/CW, $65; Heath VF-1 VFO stable CW. $10. S. Garson, 77 Luciani Rd., Woodbridge, Conn. 06525. Phone: (203) 387-5109.

FOR SALE: Tube tester dynamic type Sylvania, No. 620. Like new, $75. K9DUH, 3732 Osceola Ave., Chicago, Il. 60634.

FOR SALE: Radiola III 2 tube receiver. Circa 1924. Conversation piece, $30.00 ppd. Worcester, RD 1, Frankfort, N. Y. 13340.

BC-610 xmtr with speech amp, junction box, rectifier, coils, tuners, cables. $200. Silbert, White Sulphur Springs, P. O. Box 77, N. Y. 12787.

WANTED: Atwater Kent breadboard rcvrs and units, DeForest unit panels, parts, and receivers. Wm. B. Duck, No. 14 and other old radio catalogues. Glen Angle, K0TAM, Clear Lake, S. Dak. 57226.

4—1000 AMPLIFIER, fully metered, grounded grid, vacuum variables, shielded all band or single band. W4GD, 3087 Carnes Ave., Memphis, Tenn. 38111.

SELL: Master mobile 40 meter coil. New. $6. pp. Deluxe Joystick Antenna without tuner. Perfect. $16 pp. WA4KCN, 4921 Edenshire Ave., Memphis, Tenn. 38117.

APACHE & SB10 with cables. Perfect condx and very clean. $200. K2GQO, 131 Saddle Rock Rd., Valley Stream, L. I., N. Y. 11581.

VALPO TECH ALUMNI NET 7090 KHz, Saturdays, 1400 GMT, DE W3MSN, L. W. Briggs, 5400 Boulder Dr., Oxon Hill, Md. 20021.

JOIN THE OLD OLD TIMER's CLUB if you have been licensed for 40 years. Send your QSL for an application to C. W. Boegel, Jr., W0CVU, 1500 Center Point Rd., NE, Cedar Rapids, Iowa.

FOR SALE: Webster 'Bandspreader' Mobile Antenna. Excl. condition, $15. 80-10M coverage. Elliot Levin, 415 Sheffield, Cherry Hill, N. J.

SWAN 14-C DC module, $35. Swan 45 mobile antenna, $35. Both 1 year old, with manuals. K5-STL, 8516 James NE, Albuquerque, N. M. 87111.

WANTED: Heath kilowatt kompact HA-14, with D.C. supply. WA1DHI, 69 High St., Pittsfield, Mass. 01201.

LICENSING COURSES: The LERC Amateur Radio Club (W6LS) regularly conducts free ham courses which are open to all LA-area people. Write to: 2814 Empire Ave., Burbank, Calif. 91504.

TRADE: 12 string Hoyer acoustic Guitar w/case. Factory pick-up for SB-300 or 301. WA5NYG, 3407-47st, Metairie, La. 70001. R. W. Thimmesch.

RTTY TU ESSCO model TU-1 Demodulator & SM-1 selector magnet driver. Both factory built. $35. R. Massey, 1108 N. Morrison St., Appleton, Wisconsin. 54911.

SELL: SWAN 350 (late model), 117XC power supply, extra finals, homebrew CW filter, $315. H. Sumner, WB2ZDY, (212) 828-0594. 1767 Tenbroeck Ave., Bronx, N. Y. 10461.

DESK FAX Facsimile machines, $25. for the pair. C. B. Goodman, 5826 S. Western Ave., Chicago, Il. 60636.

H.P.Scope: Hewlett Packard Model 130B Oscilloscope for sale; excellent condx., with manual; $295. R. P. Stein, Jr., 2966 Carrizo Ln., Dallas, Texas. 75229.

SELL: NCX3/AC PS, Gonset GSB201 Lin., Heath Monitor scope, TA33. TR44. All A-1. M. Feldman, 3535 Lee, Skokie, Il. 60076.

LAFAYETTE HA225 Rcvr, S.W. & 6-160 Mtrs., Amego Preamp, 100 KC Crystal, Speaker, Cost $178. Sell $85. Geffner, 48 Park Ave., E., Merrick, N. Y. 11566.

FOR SALE: Johnson Adventurer transmitter. Like new. $45. K9DUH, 3732 Osceola Ave., Chicago, Il. 60634.

WWV Rec. Gen Micro 550. $50. CV253/ALR 38 to 1000 mc convertor, $85. J. G. Murray, 40-33 61st Street, Woodside, L. I., N. Y. 11377.

SELL: Drake 2NT, $115.00; Drake 2B, 2BQ, $190. Mint. 15022 Triskett Rd., Cleveland, Oh. 44111. Prefer pick-up.

SELL: Heathkit SB-610 Monitor Scope, excellent condx. with manual, $45. Paul Baillie, Belmont, N. H. 03220.

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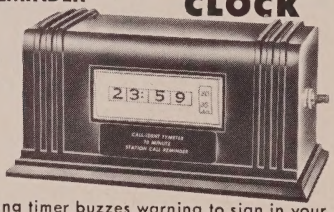

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CANADIANS: FOR SALE: EICO 753 professionally wired transceiver, latest model, good reports. $250.00. Solid State power supply, $45.00. VE3-BBN, Peter Posnikoff, RR1, Port Hope, Ontario.

FOR SALE: Mint condition, SR-400 with PS-500-AC supply, $595.00. Ampex Model 1260 4-track stereo recorder, $175.00. Will pay shipping upon receipt of certified check or money order. W5MN, P. O. Box 1835, El Dorado, Ark. 71730.

ANTENNAS: Telrex 20 meter 5 element Model 20M536 and Hy-Gain 10 & 15 meter Model DB-1015 - make best offer. Sorry, no shipping. Pick-up. W. Heckman, W1AA, 45 Andrew Ave., Hull, Mass. 02045. Telephone: (617) 925-4592.

WANTED: Gonset 66-B Transmitter. Must be in working condition. K7VIN, J. J. Gaudio, 2612 E. Sandra Terrace, Phoenix, Arizona. 85032.

HINTS AND KINKS, ARRL, Vols. 1 and 2 wanted. Tnx for offers, fellas, I have the others. Swap old radio books, magazines and parts. K8IKO, Box 222, Worthington, Ohio. 43085.

CANADIANS: Complete amateur equipment serviced by fully-equipped lic'd technician, kits wired-serviced. Bob Fransen, VE6TW, 227 Cottonwood, Sherwood Park, Alberta.

SWAP: HA-14 "KOMPACT KILOWATT," and Super-Pro Rcvr for small Xcvr. WA6GZZ, 4133 Stonecutter Way, North Highlands, Calif. 95660, Telephone: (916) 331-2185.

SELL: HT-40. Needs a little work. $25. No shipping. W0MHK, Bill Grim, 509 E. Cronkhite, Knoxville, Iowa. 50138.

FOR SALE: Tentec PM2 with 15m converter. $40 takes both. Smith, 30 Imlay Street, Hartford, Connecticut. 06105.

FOR SALE: SURPLUS BC659, PE117, C435, new tubes, 4X150D, 12A47, 2E24, OA2, RK4D32. Make offer. W. V. Fair, 3949 Menlo Drive, Doraville, Georgia. 30340.

SWAP: Gud Super-Pro for Beam or Quad Antenna and shipping. WA6GZZ, 4133 Stonecutter Wy., N. Highlands, California. 95660.

UNCASED TY-79 DC/DC xformers 6" leads, 2/$10 postpaid. R. Porrazzo, 2014 Linda Vista, W. Covina, Ca. 91791. K6CQD.

TRADE: P & H DI-1 SCOPE for 2 Element Tri-band Beam or Ham-M Rotator. Les Turner, W7-BKQ, 2213 Sunland Avenue, Las Vegas, Nev. 89106.

UHF 1500 Watt dummy load, RCA Carfone, Brid Wattmeter, Heath Sixer, New 4-65A's. WA2FFZ, 186 West Avenue, Pitman, N. J. 08071.

SELL: HQ180C. Mint condition. Recently factory-reconditioned. $240.00. FOB WB4NVJ, 1234 Windsor Avenue, Richmond, Virginia. 23227.

KNIGHT T-60 TRANSMITTER with mike and one crystal. New condition: $35.00. J. Clark, W9HJM, 2113 Lantern Hill, Urbana, Il. 61801.

WANTED: "Radio", July, 1935, "R/9", December, 1932 — November 1933 and "CQ" October 1945. A. Herridge, G3IDG, 96 George Street, Basingstoke, Hants, England.

CLEARING THOUSANDS OF BRITISH FIRST DAY COVERS AND MINT STAMPS. Interesting trial packet $2.00. G3HKO, 28 Hillcrest Avenue, Scarborough, England..

SELL: California Kilowatt, pair of 4 —1000's. Full details, SASE. Al Povol, 3538 Centerview Avenue, Wantagh, N. Y. 11793.

SELL: SWAN 350 (Late Model), 117XC, extra finals, homebrew CW filter, $315. Howie, WB-2ZDY. Tel. (212) 828-0594.

SELL: TA-33 (used), $45.00; 4 sections TRI-EX Tower (10 ft. ea.), $30.00. Both for $70.00. Pick-up only. K6RIM, 342 Lexington Wy., Burlingame, California. 94010.

FOR SALE: CQ — QST and 73 magazines at 25 cents each. WANTED: 80 Meter Transceiver and Novice and Tech. Receivers and Transmitters. Name what you have and your prices. L. M. Covey, K1-JAR, 238 Jenness St., Lynn, Mass. 01904.

McCoy Golden Guardian filter and associated xtals wanted for SSB construction project. State price & new or used. Jack, K2OUA, 173 Wood Dale Drive, Ballston Lake, New York. 12019.

FOR SALE: KWM2-A number 18922, Noise Blanker, 516F2, $975. 75S1, 32S1, 516F2, $600. Waters Nuverter, $125. Waters Codax keyer (as-is), $25. Galaxy 300, PSA300, $175. SW-260, $275. SW-350-C, 14-117-DC, $350. James W. Craig, 29 Sherburne Avenue, Portsmouth, New Hampshire. 03801.

FOR SALE: Drake 2B Rcvr matching spkr, excellent condx. $170. W1WXV, 18 Harris Ave., Johnston, R. I. 02919.

SALE: Morrow CM-1 B. C. Rcvr, use it as a tuneable !. F., shielded, $5. R. Erickson, 13 Robert So. Amboy, N. J. 08879.

SALE: Dow Key Coax relay, new, $5. First and 2nd phone course, $20. Code Practice osc. (Ameco), $10. 5 Vols Basic Electricity, and 6 Vols Basic Electronics, $8. Heathkit (Trans) Intercom, $10. H. Hastings, WA6KXB, 13445 Highway 80, Sp. 42, El Cajon, Calif. 92021.

AMECO RECORDS No. 104-33 & No. 106-33. First $6. Jeltrup, 27A Lincoln, Ossining, N. Y. 10562.

SALE: Hewlett-Packard, General Radio, Gertsch, Bird, etc., test equip. Cheap or trade for linear, 23 channel CB SASE. W4API, Box 4095, Arlington, Va. 22204.

SALE: Complete nov. station, $85. Viking Adventurer & Heathkit HR-10, both mounted in carrying case. Built in TR switch. Mint condx. W5JMH, 2328, N 1/2, Huntsville, Texas. 77340.

SELL: Old CQ, QST, Radio mag., Radio & TV mag., Pop. Sci., Pop. Mech., SASE for list. F. Kubias 4655 Lamont, San Diego, California. 92109.

SALE: Int. Xtal. QRP modules — $10. Morrow CM-1, $5. G66G77 w/flat ac pwr. supply (fits suitcase), $115. W2CVW, 13 Robert, S. Amboy, NJ

Toroids, 88 mh, uncased, 5/$1.50. pp USA-48, E. Evans, K4OEN, 220 Mimosa, Paducah, Ky.

SALE: Heathkit IM-18 VTVM hallicrafters SX101-A rcvr, $180, mint condition. Rempel, 7681 Hanna, Gilroy, Calif. 95020.

Transformer, 2800 v, CT, 1.5 KV d.c., $25. Lafayette KT200, 4 band rcvr, $30. National HFS rcvr, $20. R/S SWR indicator, 470-2800 mc, $20. W2KQA, 127 Nesbit Terr., Irvington, N. J. 07111.

SELL: SB401, manual, $250, HDP21A mike, $20, CW Filter 4SB301, $15; Hustler 4BTV Trap Vertical with 80M Resonator, $35. Fearon, 3384 Peachtree, Atlanta, Ga. 30326.

SALE: Complete station DX60, HR-10, HG10 VFO Heath SWR meter, Hy-Gain 14 AVQ Vert, Electro voice mic. Dow key ant. coupler, $120 complete or SASE for parts. You ship. WA3GAX, 2 Neponset, Wil., Del. 19810.

WANTED: Single sect. 200 pf. & a split stator 250 pf per section-both hi-power tuning caps for transmatic Jul QST. W2EHB, 32 Bryant, Blackwood, N. J. 08012.

CONSTANT voltage transformers and regulators, also variacs. Write your needs. SASE, D. R. Lee, 1228 Shelbourne, Bethlehem, Pa. 18018.

FOR SALE: Heath HW-34-A loaded, $180. C. Vinson, 2796 Larkspur St., Yorktown Hts., N. Y. 10598.

DRAKE R4B mint condx being sold for overseas serviceman going transceive. $299. Geo. Hoell, 116 Kimball, Dedham, Mass.

NCX-5, MK-2; NCX-A; XCU-27; NCL-2000 all mint condx, $650. T. Chartland, 3504 Snowglen, Lansing, Mich. 48917.

WANTED: Davco DR30, pay good price, Hellmut Schmucker, 813 Starnberg, Am Werkkanal 10, W. Germany.

FOR SALE: 2 complete Galaxy FM210 FM 2-meter transceivers, AC210 AC supplies, mobile brackets, cables, manuals, receive and transmit crystals 146.940, 146.340; Turner 350C mike, plugs, perfect, all near new. Each was $310. now $225. W0RJZ, Box 466, Creston, Iowa. 50801.

SWEEP GENERATOR, UHF T.V. range, flat within 1 DB., Philco no. G8002, Cost $289.50; new--condx. $75.00. G. Richie, 643 Diamond, Salem, Va.

NEED URGENTLY: for purchase or reprod: Manual or schematic for Allied TR108 2 meter transceiver. H. S. Lowry, 915 Madison, Manchester, Tenn.

LAFAYETTE HA225 rcvr, SW & 6-160 mtrs Ameco Preamp, 100 KC Crystal, cost 178, Sell $85. Geffner, 48 Park Ave E., Merrick, N. Y. 11566.

SELL: Swan 350, 117XC with xtal cal & opposite SB, spare finals. $350. K5SGH, 11223 Sandstone, Houston, Tex. 77072.

WANTED: Old battery operated radios of the early 1920's. Need not be in working condx. State model and price. McKenzie, 1220 W. Euclid, Indianola, Iowa. 50125.

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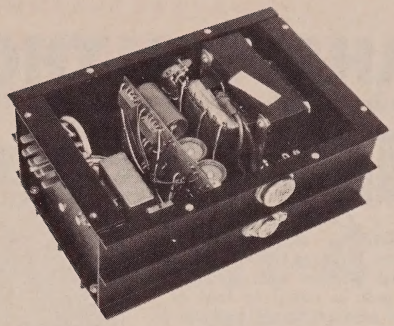
Reginair Universal DC Supply

$119.95



We announce to our ham customers the availability of the Reginair Universal DC supply complementing our line of Reginair products sold exclusively through this firm. This DC supply is a robust reliably built American-made product (actually made for us by Linear Systems Company of California), flexibly designed to provide years of highly efficient performance for nearly every transceiver available.

If you purchased your transceiver with an AC power supply and subsequently felt the need to operate in a car or a boat, you probably were somewhat aghast at the prices of comparably rated power supplies. Here is a heavier than average unit made to supply the needs of the Collins KWM1 or 2, the Drake TR3, 4 and 6, the Eico 753, the Galaxy 3, 4 or 550, the Hallicrafters 150, 160 or 500, the entire Heathkit SB100 or HW100 series, the National NCX3, 5, 200 or 500, and any or all of the Swan's including the 240, 250, 250C, 350, 350C, 400, 500 and the 500C. A special heat sink chassis with special extrusions and high quality fittings and measuring 9" long by 6" wide by 3⅝" thick houses this modern designed device. The power transformer is designed with three taps so as to provide 650, 750, 850 volts out of the transformer, while the second winding provides 250, 285 or 325 volts. Of extreme advantage to some owners is the built-in bias control. Two rectifier bridges, both conservatively rated and with appropriate filters, provide exceptionally clean outputs.

The DC input circuit is worth commenting about. Four specially selected to operate at their highest gain Solitron high voltage transistors are employed in a two-stage closed loop oscillator in such a way that high magnetizing currents are not introduced in the power transformer. Amplified feedback insures splendid regulation and easy starting. Power resistors conventionally found in switching circuits are eliminated in this design adding to the efficiency. A 12 volt DC relay and a 40 amp circuit breaker complete the picture. Here is a unit which you can very definitely be proud of. A unit you will want to keep long after you have traded your transceiver. Very exceptionally built and constructed of the best quality components, this supply has nothing of skimpy design contained in it. The quality of workmanship is superb, and the over-all accessibility permits easy subsequent service should this be necessary in that rare eventuality. When your check accompanies your order, we will prepay to US and Canadian points. Supplied with heavy primary wiring and output cable. Mention of your specific transceiver will mean that we will furnish a mating plug to match. Warranted 180 days.

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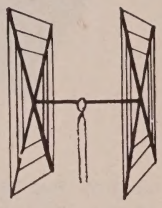
QUADS Worked 42 countries in two weeks with my Gotham Quad and only 75 watts... W3 CUBICAL QUAD ANTENNAS — these two element beams have a full wavelength driven element and a reflector; the gain is equal to that of a three element beam and the directivity appears to us to be exceptional! ALL METAL (except the insulators) — absolutely no bamboo. Complete with boom, aluminum alloy spreaders; sturdy, universal-type beam mount; uses single 52 ohm coaxial feed; no stubs or matching devices needed; full instruction for the simple one-man assembly and installation are included; this is a fool-proof beam that always works with exceptional results. The cubical quad is the antenna used by the DX champs, and it will do a wonderful job for you!



10/15/20 CUBICAL QUAD SPECIFICATIONS

Antenna Designation: 10/15/20 Quad
Number of Elements: Two. A full wavelength driven element and reflector for each band.
Freq. Covered: 14-14.4 Mc. 21-21.45 Mc. 28-29.7 Mc.
Shipping Weight: 28 lbs. Net Weight: 25 lbs.
Dimensions: About 16' square.
Power Rating: 5 KW.
Operation Mode: All
SWR: 1.05:1 at resonance
Gain: 8.1 db. over isotropic
F/B Ratio: A minimum of 17 db. F/B
Boom: 10' long x 1¼" O.D.; 18 gauge steel; double plated; gold color
Beam Mount: Square aluminum alloy plate incorporating four steel U-bolt assemblies. Will easily support 100 lbs. Universal polarization.
Radiating Elements: Steel wire, tempered and plated, .064" diameter.
X Frameworks: Each framework consists of two 12' sections of 1" OD aluminum 'hi-strength' (Revere) tubing, with telescoping ⅞" tubing and short section of dowel. Plated hose clamps tighten down on telescoping sections.
Radiator Terminals: Cinch-Jones two-terminal fittings
Feedline (not furnished); 52 ohm coaxial cable

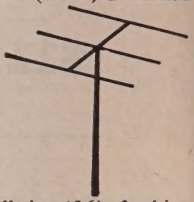
Now check these startling prices—note that they are *much lower* than even the bamboo-type:

10-15-20 CUBICAL QUAD	$37.00
10-15 CUBICAL QUAD	32.00
15-20 CUBICAL QUAD	34.00
TWENTY METER CUBICAL QUAD	27.00
FIFTEEN METER CUBICAL QUAD	26.00
TEN METER CUBICAL QUAD	25.00

(all use single coax feedline)

GOTHAM
1805 Purdy, Dept. CQ,
Miami Beach, Fla. 33139

BEAMS The first morning I put up my 3 element Gotham beam (20 ft) I worked YO4CT, ON5LW, SP9-ADQ, and 4U1ITU THAT ANTENNA WORKS! WN4DYN Compare the performance, value, and price of the following beams and you will see that this offer is unprecedented in radio history!



Each beam is brand new; full size (36' of tubing for *each* 20 meter element, for instance); absolutely complete including a boom and all hardware; uses a single 52 or 72 ohm coaxial feedline; the SWR is 1:1; easily handles 5 KW; ⅞" and 1" alumnium alloy tubing is employed for maximum strength and low wind loading; all beams are adjustable to any frequency in the band.

2 EL 20	$21	4 EL 10	20
3 EL 20	27	7 EL 10	34*
4 EL 20	34*	4 EL 6	20
2 EL 15	17	8 EL 6	30*
3 EL 15	21	12 EL 2	27*
4 EL 15	27*	***20' Boom**	
5 EL 15	30*		

ALL-BAND VERTICALS

"All band vertical!" asked one skeptic. "Twenty meters is murder these days. Let's see you make a contact on twenty meter phone with low power!" So K4KXR switched to twenty, using a V80 antenna and 35 watts AM. Here is a small portion of the stations he worked: VE3FAZ, T12FGS, W5KYJ, W1WOZ, W2ODH, WA3DJT, WB2FCB, W2YHH, VE3FOB, WA8CZE, K1SYB, K2RDJ, K1MVV, K8HGY, K3UTL, W8QJC, WA2LVE, YS1MAM, WA8ATS, K2PGS, W2QJP, W4JWJ, K2PSK, WA8CGA, WB2KWY, W2IWJ, VE3KT. Moral: It's the antenna that counts! *FLASH!* Switched to 15 c.w. and worked KZ5IKN, KZ5OWN, HC1LC, PY5ASN, FG7XT, XE2I, KP4AQL, SM5BGK, G2AOB, YV5CLK. OZ4H. and over a thousand other stations!

V40 vertical for 40, 20, 15, 10, 6 meters	$14.95
V80 vertical for 80, 75, 40, 20, 15, 10, 6 meters	$16.95
V160 vertical for 160, 80, 75, 40, 20, 15, 10, 6 meters	$18.95

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TRANSMIT: • **VOX or PTT** on SSB or AM • **Input Power:** SSB, 300 watts P.E.P.; AM, 260 watts P.E.P. controlled carrier compatible with SSB liners; CW, 260 watts • **Adjustable pi-network.**

RECEIVE: • **Sensitivity** better than ½ uV for 10 db S/N • **I.F. Selectivity** 2.1 KHz @ 6 dB, 3.6 KHz @ 60 dB. • **AGC** full on receive modes, variable with RF gain control, fast attack and slow release with noise pulse suppression • **Diode Detector** for AM reception.

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For example: RCA WV-510A operates from batteries or AC. Remove the detachable AC line cord while you're taking a measurement and the batteries take over immediately without a flicker of the pointer. And you'll get maximum life from the batteries because they're always on trickle charge during AC operation. Stability? Switch from range to range and watch a whole series of measurements without constantly zero-adjusting the meter.

Some statistics:

Current:
0.01 milliampere to 1.5 amperes in 8 ranges.

Resistance:
0.02 ohm to 1000 megohms in 7 ranges.

DC Volts:
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AC Volts:
0.2 to 1500 rms AC volts in 7 ranges plus peak-to-peak voltages of complex waveforms.
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Some statistics! For complete details, contact your local RCA Distributor.

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